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ERRATA

page 11	line 24	for '*Sphacelotheca reiliana*' read '*Sorosporium reilianum*'
46	1	for 'Bingham (T. R.)' read 'Bingham (R. T.)'
56	12	delete 'and *U. nuda*'
103	2	for '153, 158' read '153–158'
103	8	for '*edulis, Lactarius*' read '*edulis* and *Lactarius*'
125	4	for '*Eutellix*' read '*Eutettix*'
127	6	for '*tracheiphilum*' read '*niveum*'
127	7	for '*calocynthis* read '*colocynthis*'
137	23	for 'Ferreira (L. A.)' read 'Ferreira (A. L.)'
138	39	for '*Strachybotrys*' read '*Stachybotrys*'
143	42	for '*Zygospichia*' read '*Zygopichia*'
155	lines 6 and 13	for '*Achyla*' read '*Achlya*'
184	19, 28, and 33	for '*saccharatum*' read '*saccharum*'
216	line 18	for 'Florida' read 'São Paulo'
344	52	for 'bacterial' read 'bacteria'
361	45	for '*Sphaceloma*' read '*Sphacelotheca*'
387	10	for 'fungisal' read 'fungisul'
396	23	for 'Hopkins (C. J. F.)' read 'Hopkins (J. C. F.)'
405	49	for '*silvaticum*' read '*silvaticus*'

IMPERIAL MYCOLOGICAL INSTITUTE

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REUTHER (W.) & BURROWS (F. W.). **The effect of manganese sulfate on the photosynthetic activity of frenched Tung foliage.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 73–76, 1 fig., 1942.

Frenching of tung trees [*Aleurites fordii*] is stated to have been quite prevalent in localized areas in numerous plantings in the north-central part of Florida during 1941. A limited number of measurements suggests that severely affected trees have smaller leaves and less shoot growth than normal. In continued tests with manganese sulphate [*R.A.M.*, xvii, p. 781] simultaneous measurements of the rate of apparent photosynthesis were made on selected comparable leaves of 15-year-old tung seedlings, both untreated and dipped in a solution containing 1 per cent. manganese sulphate and 0·5 per cent. calcium carbonate. The experimental data do not suggest any very pronounced effect of the treatment on the rate of photosynthesis, or that frenching is a very serious yield-reducing factor. There was no noticeable effect during the first fortnight after the treatment; during the following 2½ weeks there was a significant stimulation of photosynthetic activity in the shoot leaves (on the current season's shoot growth), but none in the basal leaves (the first to unfold in the spring), the figures for the mean rate of photosynthesis, expressed as mg. carbon dioxide per 100 sq. cm. of leaf area per hour, being 8·68 and 7·95 in two lots of treated and 6·89 and 6·31 in the parallel lots of untreated shoot leaves, but 6·79 in the treated and 7·20 in the untreated basal leaves. There was practically no interveinal chlorosis of the basal leaves, whereas the shoot leaves were quite generally affected to some degree, the more severely affected of them showing a marked response to manganese treatment. In a series of comparisons made during the latter part of August and early September, both the treated and the untreated leaves resumed the normal green colour. It has frequently been observed that trees with fairly pronounced frenching symptoms on the young shoot leaves early in the spring and summer showed scarcely any chlorotic foliage later in the season.

WRIGHT (E.). **Cytospora abietis, the cause of a canker of true Firs in California and Nevada.**—*J. agric. Res.*, lxv, 3, pp. 143–153, 2 figs., 1 map, 1942.

A disease of white fir (*Abies concolor*) and red fir (*A. magnifica*), observed for the first time in 1929 in the forests of the northern Sierra Nevada, is stated to be due to attacks by a fungus tentatively identified, in the absence of the mature perfect stage, as *Cytospora abietis*. The fungus usually first enters the lower branches, probably through a wound or a fire scar, and thence spreads into the main stem and the branches above, causing a flow of resin, the formation of elliptical cankers, and a die-back of the branches (mostly those less than 1 in. in diameter) by girdling, within one to several years of infection. Yellow spore horns develop from raised pycnidia in the late spring and early summer, and are particularly abundant after rainy periods. On red fir the fungus was commonly found associated with mistletoe hypertrophies. The disease is favoured by drought, particularly in weakening fast-growing

firs previous to infection, while its spread is helped by bark beetles, aphids, and ants. In pathogenicity tests, unsatisfactory results were obtained from slit inoculations, whereas the cork-borer method (consisting in forcing a No. 2 cork-borer through the bark down to the xylem, placing the inoculum in the hole, and adjusting the bark disk on top of it by a strip of waterproof adhesive tape) gave 13·6 per cent. infection in branches of healthy and 94·9 per cent. in those of naturally infected trees, indicating the semi-parasitic nature of the fungus. Isolates of *C. abietis* from white and red fir, when placed in the same Petri dish, showed a tendency to mutual aversion, but in a series of cross-inoculations both isolates readily infected either host with an equal degree of virulence. It is concluded from these studies that the fungus is endemic in the forests of the Sierra Nevada and only assumes epidemic proportions when the firs are weakened by drought or some other environmental factor.

CARTWRIGHT (K. ST. G.) & FINDLAY (W. P. K.). **Principal decays of British hardwoods.**—*Ann. appl. Biol.*, xxix, 3, pp. 219–253, 6 pl., 1942.

Continuing their earlier studies [*R.A.M.*, xviii, pp. 221, 361], the authors give full descriptions of the principal forms of fungal decay attacking British hardwoods other than oak. The most prevalent fungi causing decay in standing trees of the common British broad-leaved species are listed under the trees affected, viz., alder, ash, false acacia (*Robinia pseud-acacia*), beech, birch, cherry, horse-chestnut (*Aesculus hippocastanum*), sweet chestnut (*Castanea sativa*), elm, lime (*Tilia vulgaris*), oak (*Quercus robur* and *Q. petraea*), pear, apple, plum, poplar, sycamore (*Acer pseudoplatanus*), walnut, and willow (*Salix* spp.). The chief diagnostic features of the more important fungi attacking ash, beech, elm, and willow, and fallen hardwoods in general are presented in a series of tables. Detailed descriptions are given of the following fungi causing deterioration in felled and stored hardwoods, of their appearance in culture and their physiological characteristics, together with notes on the rots caused, and their economic importance: *Armillaria mucida* [ibid., xvii, p. 363], *Daldinia concentrica* [ibid., xviii, p. 356], *Fomes fomentarius*, *F. ulmarius* [ibid., xviii, p. 4; xxi, p. 59], *Ganoderma applanatum*, *Pleurotus ostreatus* [ibid., xix, p. 658], *Polyporus betulinus*, *P. cuticularis* [ibid., xvi, p. 425], *P. giganteus*, *P. hispidus*, *P. radiatus*, *P. squamosus*, *Polystictus versicolor*, *Poria obliqua*, *Stereum purpureum*, and *Ustulina vulgaris*. Of these *P. versicolor* [ibid., xx, p. 142] is treated in the fullest detail, as being, probably, the most important.

GRANT (T. J.), STOUT (D. C.), & READEY (J. C.). **Systemic brooming, a virus disease of Black Locust.**—*J. For.*, xl, 3, pp. 253–260, 4 figs., 1 graph, 1942.

Data obtained from the examination and identification of black locust (*Robinia pseud-acacia*) specimens affected by witches' broom [*R.A.M.*, xii, p. 405; xvi, p. 717] show the disease to have been present in North Carolina and Pennsylvania for over 70 years and establish its occurrence in Delaware, Virginia, District of Columbia, and Georgia prior to 1900. Intensive greenhouse and field studies of the disease have revealed the existence of degrees of the trouble ranging from severe through mild brooming to the symptomless presence of the virus in apparently healthy trees. Vein-clearing of the leaflets is an outstanding feature of the disorder in the early stages, and is also the last symptom to be observed on plants recovering from other manifestations of witches' broom. Length and width measurements (by W. G. Cullen) of 1,080 leaflets showed the average mildly affected specimen to be about half, and a severely diseased specimen one-thirteenth as large as a normal leaflet. On the basis of 225 measurements the average lengths of comparably situated petioles were 18·7, 12·5, and 2·7 cm. for healthy and mild and severe brooming, respectively; a tendency to curling and twisting of the petioles is apparent on diseased plants. Foliar symptoms are confined to leaves in which infection was already apparent before expansion in the leaflet stage; these are apt to turn yellow and fall abnormally

early. The characteristic proliferations of buds and branches arise from the continuous development of the axillary buds into short, succulent branches bearing leaves and leaflets of reduced size and modified shape. Frequently a leaf with a branch of this type in its axil drops from the plant, to be replaced by one or more subpetiolar buds. Very severe brooming may be accompanied by adventitious bud formation, but more commonly the branches arise from normally located buds. Excessive branching usually involves a reduction in height increment, and diseased plants often fail to survive competition in crowded stands. Root brooming is a sequel to the repeated arrest of terminal growth. Of 279 root cuttings from broomed plants, 67 per cent. made no growth, 20 per cent. produced apparently healthy sprouts, while only 13 per cent. gave rise to sprouts with witches' broom symptoms, those severely affected living only for a few months, whereas in milder cases transplanting was survived. Of 120 controls from healthy plants, 33 per cent. failed to grow, and the remainder produced sound sprouts.

Witches' broom of black locust is most prevalent on young sprouts in areas where the plant growth has been repeatedly cut back or the roots cut, e.g., highway and railway banks, building lots, gardens, and ploughed fields. Spring observations of 629 first-order branches bearing old brooms showed that 55 per cent. were entirely dead, 36 per cent. were alive in the lower portion, and in only 9 per cent. was there evidence of new growth developing over the whole length, the corresponding figures for mild broom being 28, 55, and 17 per cent., respectively.

By grafting diseased scions on healthy stocks, the transmission of witches' broom was effected in 19 to 50 per cent. of the 150 plants used in several different tests, whereas budding was successful in only two plants out of 30 and negative results were given by attempts to infect healthy plants by means of juice extracts and insects.

Roldan (E. F.). **Nursery wilt of Mahogany seedlings.**—*Philipp. J. For.*, iv, 3, pp. 267–277, 3 pl., 2 figs., 1941.

An epidemic of wilt, involving some 27,000 out of 300,000 mahogany (*Swietenia macrophylla*) seedlings in the Makiling National Park, Manila, broke out during the early part of 1939, the conspicuous symptoms of prostration and a dull green to brownish discoloration and drooping of the leaves developing quite suddenly. The disease was uniformly fatal, and further observations in the infected patches showed that many of the seeds had rotted without germinating. The fungus isolated from the affected plants on various standard media proved to be a species of *Sclerotium*, which was identified on the basis of its diagnostic characters, including sclerotial measurements (0·63 to 5·17, average 2·5 mm.), as *S. delphinii*, the agent of seed and seedling stem rot of the mango in the Philippines [*R.A.M.*, xiii, p. 387]. In three series of inoculation experiments with sclerotia from pure cultures of the fungus on potato dextrose agar positive results were obtained in 14, 19, and 10 out of 24 seedlings (58, 79, and 41 per cent., respectively), and in all four mango seedlings similarly treated. Control measures should be based on the avoidance of conditions favouring the development of the pathogen (the first to be recorded on mahogany in the country), e.g., shady sites with a low temperature and high humidity, and overcrowding of the seedlings.

Aguilar (L.). **Relative durability of untreated Philippine woods (a progress report).**—*Philipp. J. Agric.*, iv, 3, pp. 247–256, 2 pl., 1941.

Tested since 1907 by the 'graveyard' method, in which samples of wood are inserted partially or wholly in the ground and exposed to decay by termites and fungi, at least ten native Philippine timbers proved to be more durable than *Intsia bijuga*, which was taken as the standard and given the value of 100 per cent., its average life under the experimental conditions being 11½ years. They were *Xanthostemon verdu-*

gonianus, *Vitex parvifolia*, *Vatica* spp., *Shorea seminis*, *S. astylosa*, *S. gisok*, *Mimusops parvifolia*, *Hopea mindanensis*, *Tristania* sp., and *Pahudia rhomboidea*, with percentages of 224, 184, 171, 121, 110, 110, 108, 105, 104, and 102, respectively. Using an arbitrary classification of (1) very durable, i.e., a relative durability of 80 per cent. and over, (2) durable (40 to 79 per cent.), (3) moderately durable (21 to 39 per cent.), (4) perishable (10 to 20 per cent.), and (5) very perishable (less than 10 per cent.), 25, 26, 34, 47, and 50 species, respectively, fell into the five categories. The very durable woods may be expected to resist decay for nine years and upwards under the most exacting conditions.

Bland (D. E.). **A study of the toxicity of Australian vertical retort creosote oils to Lentinus lepideus Fr., Polystictus versicolor (L.) Fr., and Madison 517.**—*J. Coun. sci. industr. Res. Aust.*, xv, 2, pp. 135–146, 1942.

Australian vertical retort creosote oils were shown experimentally to exhibit substantially the same toxicity to the wood-destroying fungi *Lentinus lepideus*, *Polystictus versicolor*, and Madison 517 [*R.A.M.*, xvii, p. 5] as horizontal retort oils. Vertical retort oils of lower creosote boiling range were more toxic than those of higher range. The most toxic fraction of vertical coal-tar oil was that distilling between 225° and 275° C. Most of the toxicity of the vertical retort oils was found to be due to the tar acids, the most toxic fractions of which were those boiling at over 250°. The constituents of a creosote oil were not found to act independently of one another.

Bowen (J. W.). **The preservation of timber and fabrics with reference to utilization underground.**—*J. chem. Soc. S. Afr.*, xlii, 5, pp. 122–135, 5 figs., 3 graphs, 1941.

Much of the information presented in this useful survey of investigations on the preservation of mining timbers, consisting almost exclusively of wattle [*Acacia mollissima*] and *Eucalyptus saligna*, in South Africa has already been noticed from another source [*R.A.M.*, xxi, p. 109], but the following points are of interest. Generally speaking, the attacks of fungi of the white rot group, e.g., *Polyporus rugulosus* and *Polystictus versicolor*, do not appreciably change the proportions of the different constituents of the wood, whereas the brown rots, such as *Coniophora cerebella* [*C. puteana*] and *Hydnum* sp., bring about a considerable reduction in pentosans and cellulose relative to the percentage lignin. In 1935 6,000,000 cu. ft. of timber for the Witwatersrand mines underwent preservative treatment, the corresponding figure for 1937 being 8,000,000 and that estimated for 1942 25,000,000 cu. ft.

Since 1925 experiments have also been in progress at the Timber Research Laboratory, Transvaal Chamber of Mines, to determine the most effective method of protecting the various fabrics used underground against fungal decay, e.g., by *Penicillium canescens*, which has been found to destroy untreated flannel air-filtration bags, worth £3 to £10 each, in less than a month. The best protection of this material has been afforded by cuprinol [ibid., xviii, p. 726], while shirlan, halogenated soaps, cutch, and copper oleate [ibid., xix, p. 95], iron and chromium hydroxide, thallium carbonate, sodium silicofluoride, the copper salts of fatty acids, creosote, copper carbonate, and zinc chloride have also given good results in tests for special purposes.

Christensen (C. M.), Kaufert (F. H.), Schmitz (H.), & Allison (J. L.). **Hormodendrum resinae (Lindau), an inhabitant of wood impregnated with creosote and coal tar.**—*Amer. J. Bot.*, xxix, 7, pp. 552–558, 2 figs., 1942.

A fungus tentatively identified as *Hormodendrum resinae* was recently isolated from various creosoted wood products, such as railway sleepers, poles, and fence

posts, in many different parts of the United States, where it appears to be a very common and general inhabitant of wood impregnated with coal tar and coal tar creosote. Nearly all attempts to isolate the fungus from creosoted wood blocks, plant refuse, soil, and asphalt street pavements gave negative results, but resinous bark and twigs from 15 spruce trees affected with *Cytospora* canker gave *H. resinae* in 13 instances. This and other resinous woods may possibly form one of the natural habitats of the organism.

Cultures of the fungus on malt and potato dextrose agars are white when very young but turn dark olive-brown or nearly black in a few days. The mycelium is appressed but the numerous spores give the cultures a powdery appearance. The spores are pale olive-brown, from spherical to elongate-oval, 3·2 to 9 (average 4·5) μ in length (average of 5·1 μ for a strain isolated from western red cedar [*Thuja plicata*]). *H. resinae* has a high optimum temperature (about 30° C.) and a wide temperature range (from 5° to 40° at least). It grew over a wide P_H range at very varying rates and altered the P_H value of the medium. It was moderately resistant to arsenic, and extremely tolerant of coal-tar products, growing on agar containing as much as 10 per cent. creosote or coal-tar, whereas *Coniophora cerebella* [*C. puteana*], Madison 517, *Lenzites sepiaria*, and *Trametes serialis* were killed at creosote concentrations of 0·05, 0·3, 0·3, and 0·2 per cent., respectively. It appears to derive nourishment from the constituents of typical coal-tars and creosotes used as wood preservatives. It grew luxuriantly on wood sterilized to eliminate all competitive fungi (*Penicillium*, *Aspergillus*, and *Trichoderma* spp.) but was unable to compete with these organisms. Other experimental evidence indicated that it cannot long survive in the soil in competition with other fungi.

That the fungus has no appreciable effect on the strength of the wood it infects was indicated by the excellent condition of the samples, and this view was confirmed experimentally.

An unidentified bacterium was isolated from most of the pieces of creosoted wood from which the isolations of *H. resinae* were made.

NARAYANAMURTI (D.). **A short note on wood preservation for users in India.**—*Indian For. Bull.*, N.S., Utilis., 110, 21 pp., 4 pl., 1 diag., 1941.

Following an outline of the history, aim, and scope of timber preservation, with special reference to Indian conditions, the standard methods of impregnation with oils, water-soluble preparations, and toxic chemicals dissolved in volatile solvents, are described and discussed in relation to the practical and economic aspects of the various procedures [*R.A.M.*, xix, p. 632]. Brief supplementary notes are given on the protection of logs and poles by air-seasoning, and on the prevention of decay in buildings.

LE BEAU (F. J.) & PINCKARD (J. A.). **Oospore production in Cabbage seedlings by Peronospora parasitica.**—Abs. in *Phytopathology*, xxxii, 7, p. 648, 1942.

Oospore formation by *Peronospora parasitica* was abundant in the cotyledons and sparse in the true leaves of field-grown cabbage seedlings in south-central Mississippi, where the process was apparently related to moisture, temperature, and light intensity, the fructifications being most profuse in the tissues of seedlings in dense stands on the south side of wood-enclosed frames during November and December. Dry, sunny periods were found to interrupt the heavy production of oospores occurring in rainy weather by the desiccation of the invaded tissues supplying the fungus with food. In the greenhouse cabbage seedlings surrounded by cheese-cloth produced large numbers of oospores for 15 days after inoculation in the presence of a continuously moistened atmosphere. The life-cycle of *P. parasitica* would thus appear to conclude

with oospore production, chiefly in the cotyledons, oversummering being effected by means of these bodies rather than by perennial mycelium in weed hosts.

MOGILEV (L. M.) & RYACHOVSKY (N. A.). Устойчивые к аскохитозу (**Ascochyta pisi Lib.**) чистые линии сорта Гороха "Виктория Гейне" [Pure lines of the Pea variety 'Victoria Heine' resistant to *Ascochyta pisi* Lib.].—*C. R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 3, pp. 11–12, 1941.

In preliminary trials conducted during 1938 in the Voronezh district of the U.S.S.R., 500 pure lines of the pea variety Victoria Heine were tested for resistance to *Ascochyta pisi* [*R.A.M.*, xx, p. 440] and four highly resistant and two medium resistant ones were reserved for further trials. After the failure of the 1939 tests owing to drought, seeds of these six lines were sown again in 1940 in artificially infested soil in the field. The degree of infection was estimated according to a scale ranging from 0 for a healthy plant, to 3 for plants showing over 50 per cent. of their entire surface (leaves and stems) diseased. On this basis the 1940 results showed that all the six pure lines were far more resistant than the standard Victoria Heine, which received marks of 1·87 and 2·15 for the vegetative parts and fruits, respectively, whereas the corresponding marks for line 405 were only 0·05 and 0·005; for line 53 only 0·17 and 0·02; and none of the remaining lines 61 (originally placed in the medium resistant group), 161, 363 [? and a sixth line] had higher marks than 0·95 and 0·52, respectively. It is pointed out that individual plants within a resistant line are sometimes less resistant than the rest, indicating the necessity of repeated selection of particularly resistant plants. The selected resistant lines did not significantly differ from each other or from the standard Victoria Heine in their morphological and biological characters, and are considered to promise high yields.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 7, pp. 331–334, 5 figs., 1942.

Onion downy mildew (*Peronospora destructor*) [*P. schleideniana*: *R.A.M.*, xix, p. 324; xx, p. 442] occurs every spring in the coastal areas of New South Wales, frequently causing considerable reduction of yield. In wet seasons, the disease is also important in the inland parts of the State. Attack is generally followed by leaf mould due to *Macrosporium parasiticum* [*Pleospora herbarum*: ibid., xiii, p. 614]. This fungus appears to be unable to effect an entry into onion leaves unless they have already been weakened by some other agency. Sources of downy mildew infection of a young onion crop include diseased leaves left in the field from the previous crop, which carry resting spores capable of infecting the new crop, diseased bulbs used for seed, which produce an abundance of spores on the first-formed leaves, and diseased or contaminated seed (i.e., carrying the fungus within the seed coat, or as an external contaminant). The disease may be kept in check by crop sanitation and rotation, air and soil drainage, good cultural practices, and seed treatment. With regard to the first of these, all dead tops, discarded bulbs, etc., should be collected and burned after the onions have been harvested; onions should be grown on the same land only once every three or four years; bulbs for seed should be taken from healthy plants, and the seed plot should be as remote as possible from the bulb crop. If there is any doubt about the healthiness of the seed, it should be steeped (tied loosely in a cheese-cloth ¼ lb. at a time) in water kept at 122° F. for 25 minutes.

Onion smut (*Urocystis cepulae*) [ibid., xx, pp. 442, 443] has not yet become established in New South Wales, but it has been detected on onions imported from New Zealand [loc. cit.]. It is thought that the disease was introduced into New Zealand with onions imported for culinary purposes, some of which were used for seed

production, and it is emphasized that on no account must onion bulbs imported into New South Wales be used for seed purposes.

SMITH (J. B.) & HOWARD (F. L.). **Response of Cos or Romaine Lettuce to chloropicrin soil treatment, phosphate, and lime.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 552–556, 1 graph, 1942.

In pot experiments conducted from 1939 to 1941, Cos or Romaine lettuce plants were grown in soils taken from the Rhode Island Experiment Station Farm where they had previously been cropped for over 40 years, to which various fertilizers and chloropicrin [*R.A.M.*, xxi, p. 423] were added. The results indicate that field soil of this type fails to produce a good crop of lettuce owing, it is suggested, to the presence of injurious and competitive micro-organisms in the soil. Chloropicrin, injected into the soil at the rate of 5 c.c. per cu. ft., was found to increase the yields by eliminating these organisms, particularly when used together with phosphate applied as monocalcium phosphate up to an equivalent of 12,000 lb. 20 per cent. superphosphate per acre, and when the soil acidity was adjusted by liming to above P_H 6·0.

Agricultural research.—*Rep. E. Afr. agric. Res. Sta., 1941*, p. 3, 1942.

In experiments carried out by the Plant Pathologist [Dr. H. H. Storey] the brown streak virus of cassava [*R.A.M.*, xxi, p. 241] was shown to be transmissible by the white fly [*Bemisia* sp.] responsible for the conveyance of mosaic from infected to healthy plants. As in previous years, the incidence of both diseases was very high in the Kizugu trial plots, but a number of clones were free from one or both, a cassava × cassava cross of the 1937 series, for instance, remaining entirely free from mosaic in this second test.

MAIER (W.) & MITTMANN-MAIER (GERTRUD). **Untersuchungen über den Wuchsstoffgehalt gesunder und reisigkranker Reben.** [Studies on the auxin content of healthy and reisig-diseased Vines.]—*Wein u. Rebe*, xxiv, pp. 109–124, 1942. [Abs. in *Chem. Zbl.*, cxiii (ii), 11, p. 1251, 1942.]

At the Geisenheim (Rhine) Viticultural and Horticultural Research Station the shoot tips of healthy vines were shown by means of the *Avena* test to contain about three times as much auxin as those affected by 'reisigkrankheit' [court-noué : *R.A.M.*, xviii, p. 652], larger amounts being present in the younger and more vigorous shoots of the sound plants than in the older and weaker ones. In general, the auxin content of sharply downward bending shoots was relatively high. It is still uncertain whether the affected vines actually produce less auxin or whether the growth substance is partially destroyed by the virus.

SNYDER (E.) & HARMON (F. N.). **Some effects of zinc sulphate on the Alexandria Grape.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 325–327, 1 fig., 1942.

The fruit yields of vigorous six-year-old grafted Muscat of Alexandria vines, which had been producing very loose clusters but showed no foliar symptoms of little leaf (or zinc deficiency) [*R.A.M.*, xiv, p. 768], were practically doubled in trials in California during 1938 to 1941, when a solution of 2 lb. zinc sulphate in 1 gal. water was brushed on the pruning cuts within an hour after pruning. This increase in yield occurred in spite of the fact that some injury was caused to dormant buds on the spurs, and was apparently due to a better setting of berries. The vine growth, estimated by the pruned wood weights at the end of the season, was not influenced by the treatment. It is concluded that the poor setting in the vines under investigation might be associated with zinc deficiency.

WILLIAMS (P. H.) & SELMAN (I. W.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1941*, pp. 45–52, 1942.

In this report [cf. *R.A.M.*, xx, p. 446] P. H. Williams states that on 17th February, 1941, seeds received from California of the American tomato variety Riverside and of unnamed selections from crosses between this variety and others (all resistant to *Verticillium albo-atrum* and *Fusarium bulbigenum* var. *lycopersici*) were sown at Cheshunt, together with seed of the English varieties Ailsa Craig and Potentate (susceptible to both diseases) and Manx Marvel (reputedly resistant). The plants were potted, and inoculated with each fungus under the ball in direct contact with the roots. By 21st October, *V. albo-atrum* had been recovered from all the inoculated plants except one. Two of the unnamed selections, 40004–11 and 40005–17, were significantly more resistant to this fungus than American Riverside, Ailsa Craig, Potentate, or Manx Marvel. American Riverside appeared to be the most susceptible variety, followed closely by Ailsa Craig. Manx Marvel was more resistant than Ailsa Craig, but not significantly so. No conclusions could be drawn with regard to *F. bulbigenum* var. *lycopersici*.

In an experiment made by I. W. Selman to study the effect of varying amounts of lime and potash on tomato plants inoculated with spotted wilt [ibid., xx, p. 430], 60 seedlings were potted in a medium clay loam deficient in soluble potash and containing no free lime (P_H 5·5 to 5·7). Dried blood and superphosphate were added; lime was applied at the rate of 0, 0·2, 0·6, and 1·8 gm. per pot, and for each level of lime sulphate of potash was applied at 0, 0·1, 0·3, 0·9, and 2·7 gm. per pot. Each treatment was applied to three plants. At the seventh leaf stage, all the seedlings were inoculated by wiping every leaf with muslin soaked in infective juice. Twenty-one days after inoculation spotted wilt symptoms were present on all the 15 plants that received no lime, on all those given 0·2 gm. lime, on 13 given 0·6 gm., and on 12 only of those receiving 1·8 gm. The symptoms varied with the amount of lime. In the series with no lime, leaf-reflexing was well defined, secondary black, chocolate, or light-brown spots or a chocolate glaze appeared, and the leaves tended to roll up, displaying the under sides of the veins, which were purple. With 0·2 gm. lime, leaf-reflexing was general, light brown or chocolate spots appeared, but no black ones, or the leaves showed a general bronzed glaze, or a few plants showed local, necrotic, primary lesions only, and some plants developed leaf roll symptoms. With 0·6 gm. lime, leaf-reflexing was present, severe lesions developed (yellow, black, or brown spots, or zonate, brown spots, or coalescing brown patches, some of which killed the leaf), only one plant developed glazed bronzing, and the tendency to leaf roll was at a minimum, only three plants showing this symptom. With 1·8 gm. lime, leaf-reflexing was slight, few spots were produced, but these often killed individual leaves, bronzing was seldom apparent, and only ten plants showed leaf rolling, which was very slight. There was very little evidence of change in the length of the incubation period under different potash levels, and no consistent differences in the symptoms displayed. It was observed, however, that the plants given no lime and 0·3 gm. sulphate of potash developed spotted wilt symptoms most readily.

Stem stripes or streaks in tomato plants are now known to be associated directly or indirectly with the following factors: (1) the viruses of mosaic, enation mosaic, tobacco mosaic, aucuba mosaic, and spotted wilt, and mixed potato and tomato viruses, in combination with temporary water shortage in porous, well-fertilized soils, mineral deficiency, especially potash shortage, unbalanced fertilizers, or high temperatures with low light intensities; (2) infection with *Bacillus* [*Erwinia*] *lathyri*; (3) water shortage alone under the conditions mentioned above, potash deficiency alone, and toxic chemicals. By far the commonest cause of streak, however, is tomato mosaic plus faulty cultural methods.

A two years' study of the growth and fruiting of Potentate tomatoes infected

with tomato mosaic when the first and the fifth trusses were in bloom [ibid., xx, pp. 447, 607] showed that early infection consistently produced a significant reduction in the numbers of fruits, a non-significant reduction in average fruit weight, a significant reduction in the total yield of ripe fruit, and an increase in the percentage (by weight) of blotchy fruit. The results in 1941 differed from those obtained in 1940 in that in 1941 early infection did not reduce the number of flower buds formed or the number of leaves produced, and did not significantly affect the growth rate of the stem. The difference between these results is attributed to the fact that in 1941 nitrogen supply, atmospheric humidity, and soil moisture were all greater than in 1940. The importance of the partial failure of the flowers to set fruit in the early infected plants in relation to final yield was shown in the close correlation between the yield of the individual trusses and the numbers of fruits maturing on each truss. The evidence suggests that the effect on fruit set of virus infection is more severe when infection occurs in early spring than when it takes place about midsummer. The relative reduction in fruit yield caused by early infection fell from 22·3 per cent. in 1940 to 13·4 per cent. in 1941. Also, the absolute yields per plant were higher in both early and late infected plants in the second year, indicating that better cultural conditions will reduce losses due to early attack by tomato mosaic.

CONNERS (I. L.). **Twenty-first Annual Report of the Canadian Plant Disease Survey, 1941.**—xviii+102 pp., 1942. [Mimeographed.]

In this report [cf. *R.A.M.*, xxi, p. 121], the author states that during 1940 wheat stem rust (*Puccinia graminis*) caused little damage in western Canada. In the important 'rust area' in Manitoba and eastern Saskatchewan, rust-resistant varieties have almost completely replaced susceptible bread wheats, and there was scarcely any rust on any variety. In late fields, beyond the rust area, stem-rust damage was moderate to severe in Saskatchewan and slight to moderate in southern Alberta. Infection was more prevalent than usual near Lethybridge and in the vicinity of the Peace river. In eastern Canada, infection was moderate to severe in only an occasional field.

The average loss in yield due to common root rot of wheat (*Helminthosporium sativum* and *Fusarium* spp.) was estimated at 12·1 per cent., as against 16·6 per cent. in 1940 [loc. cit.].

Wheat kernel smudge [loc. cit.] was less prevalent in the Prairie Provinces than in 1940. *Alternaria* spp. and *H. sativum* were the fungi most commonly associated with the condition, the latter appearing to cause the more severe forms of it.

F. graminearum [*Gibberella zeae*] was isolated for the first time from blighted wheat heads in Manitoba in 1941 [cf. ibid., xx, p. 101], having been found only twice before in seed wheat.

Lucerne bacterial wilt (*Phytomonas insidiosa*) [*Corynebacterium insidiosum*: ibid., xx, p. 102] continued to be destructive in the irrigated areas of southern Alberta, and occurred in several new localities in the dry interior of British Columbia.

Potato bacterial ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*: ibid., xxi, p. 390] became more prevalent in the irrigated parts of southern Alberta, being present on 102 farms, as against 89 in 1940, and 40 in 1939. It was found in new localities in Saskatchewan, Manitoba, Ontario, and Quebec, particularly in table stock. More fields were rejected because of the disease in Quebec and New Brunswick in 1941 than in 1940. In Prince Edward Island, however, where certified seed production is a very important industry, only one case was found, as against 25 in 1940. Late blight (*Phytophthora infestans*) of potatoes was prevalent in the coastal areas of British Columbia, and was reported for the first time from the interior. After an interval of 13 years it again appeared in Manitoba [ibid., vii, p. 558], and caused considerable damage in the Red River Valley. It was also destructive in northern Ontario, north-western Quebec, New Brunswick, and Prince Edward Island, the

epidemic in the last-named locality being perhaps the heaviest ever experienced. Potatoes infected by *Synchytrium endobioticum* were found in a small garden near Halifax, Nova Scotia, which had been under cultivation for 60 years. The garden was at once cleaned up, and the affected material destroyed. All clues as to the source of infection were investigated, but to no purpose, and arrangements were made for a further search the following summer. The owner agreed to refrain from growing potatoes on the plot until permitted to do so by the Department of Agriculture. Meantime, the garden is to be visited at regular intervals, and all steps are being taken to prevent spread and find any other centres of infection that may be present.

Tomato bacterial speck (*Phytomonas* [*Bacterium*] *tomato*) [ibid., xii, p. 555] was observed for the first time in 1940 in Manitoba, where, in one instance, it caused heavy losses. *P.* [*Xanthomonas*] *vesicatoria* [ibid., xxi, p. 341], previously known in Ontario and Quebec, was reported from Manitoba and Nova Scotia.

Erwinia amylovora was reported for the first time in Alberta on apple. The disease now occurs in every province in Canada, but has never been of any importance in the Annapolis Valley, Nova Scotia [ibid., xviii, p. 725]; it remains a problem in Ontario and Quebec, where it caused a moderate epidemic in 1941.

Records of the virus diseases of stone fruits included X disease of peach and chokecherry [ibid., xxi, p. 259] in Ontario, western X disease of peach [see below, p. 32] in British Columbia, prune mosaic [cf. ibid., xix, p. 417; xx, p. 371] on prune and peach in Ontario and British Columbia, line-pattern mosaic in Shiro plums in Ontario [ibid., xxi, p. 146], and cherry mottle leaf and little cherry (? virus) in British Columbia.

D. J. MacLeod is stated to have proved experimentally that yellows of buckwheat, carrot, China aster, phlox, and the weed *Hieracium floribundum* is caused by *Callistephus* virus 1 [aster yellows virus]. This virus was found on lettuce in Manitoba and Quebec, on *Helichrysum* in New Brunswick, on snapdragon [*Antirrhinum*] in Prince Edward Island, and on *Calendula* in New Brunswick and Prince Edward Island.

New records include *Phyllosticta pteridis* on greenhouse ferns, *Ramularia macrospora* on Canterbury bells [*Campanula* sp.], *Cladosporium cyclaminis* on cyclamen, *Ascochyta aquilegiae* on larkspur [*Delphinium* sp.], *Sphaerotheca humuli* on meadowsweet [*Spiraea* sp.], *Phytomonas* [*Xanthomonas*] *hederae* on English ivy, and *P.* [*Bact.*] *tardicrescens* on iris [ibid., xviii, p. 31].

WILLIAMS (R. O.). **Trinidad and Tobago. Administration Report of the Director of Agriculture for the year 1941.**—14 pp., 1942.

This report [cf. *R.A.M.*, xxi, p. 281] contains on pp. 11–12 the following items of phytopathological interest. A field test on the control of witches' broom of cacao (*Marasmius perniciosus*) is in progress, in which the brooms are being thoroughly cut in June–July and October–November; monthly counts are made of the brooms on a large number of marked trees in blocks where brooms have been cut, and in surrounding areas in which no attempt at control is made.

Dr. F. J. Pound reports (on p. 10) that the incidence of witches' broom on 2,500 trees, mostly imported from Ecuador, was as follows: a small percentage showed no infection, a large percentage had a very small number of infections, and a small percentage were heavily infected. Material imported from the Amazon grew less rapidly than that from Ecuador, but exhibited a similar range of disease incidence.

Trial plots of I.C. 2 bananas at Tamana and Grande Riviere were severely attacked by 'moko' disease [*Bacterium solanacearum*].

WIEHE (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1941*, pp. 11–13, 1942.

In this report [cf. *R.A.M.*, xxi, p. 125] on plant disease work in Mauritius in 1941,

it is stated that red rot [*Colletotrichum falcatum*] was more prevalent than before on M. 134/32 sugar-cane in certain localities, but the percentage infection was low, indicating commercial resistance. A positive correlation was found to exist between date of planting and frequency of infection, and it is recommended that M. 134/32 should be planted during the period May–August in order to escape infection. The M. 168/32 variety was severely affected.

When *C. falcatum* was grown on a peptone-saccharose medium containing 0·01 to 0·04 per cent. gallic acid, tannic acid, resorcinol, or tyrosin, tannic acid and resorcinol markedly reduced growth at concentrations over 0·02 per cent. Gallic acid and tyrosin had no significant effect. Phenolic compounds isolated from cane stems had no adverse effect on growth.

Tobacco black shank (*Phytophthora parasitica* var. *nicotianae*) was more prevalent than during the previous year, probably as a result of high temperatures in June, July, and August.

Satisfactory control of 'herbe tourterelle' (*Wickstroemia indica*) by experimental infection with *P. parasitica* was obtained [ibid., xx, p. 291], but further experiments will be necessary before large-scale inoculations can be attempted.

Maize varieties newly introduced from South Africa, and growing in experimental fields in two localities, were attacked by a rapid soft rot of the stem tissues near the base, causing the stalks to topple over. Hickory King was the variety most severely affected. A bacterium isolated from diseased material closely resembled *Bacterium dissolvens*, not previously recorded on the island. Preliminary tests indicate that the local variety of flint maize is more resistant than the introduced maize varieties.

New records for the year included maize smut (? *Sphacelotheca reiliana*).

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 6, pp. 281–285; 8, pp. 380–387, 21 figs., 1 diag., 1942.

Full directions are given for the treatment of vegetable seeds with (*a*) copper carbonate, copper oxychloride, red cuprous oxide, and the organic mercury dusts, ceresan and agrosan, preparations of the former group generally being applied at the rate of one level teaspoonful per lb. of seed and those of the latter at $\frac{1}{4}$ to $\frac{1}{2}$ this dosage (suitable for beet, carrot, cucurbits, peas, spinach, and tomato); (*b*) immersion in a fungicidal solution, e.g., ten minutes in acidulated mercuric chloride (4 oz. in 1 qt. hydrochloric acid per 25 gals. water) for potato tubers, 5 minutes in mercuric chloride ($\frac{1}{4}$ oz. in $12\frac{1}{2}$ pts. water) for tomato seed, and 24 hours in 0·6 per cent. acetic acid or four days' fermentation soak, for tomato against canker [*Corynebacterium michiganense*: *R.A.M.*, xvii, p. 79]; and (*c*) steep in hot water (50° C.), 25 minutes for cabbage and onion, 18 for other crucifers, and 10 for celery at 57°.

An exceptionally severe outbreak of orange melanose [*Diaporthe citri*] in 1942, causing heavy damage ('tear staining') on Washington Navels, and moderate injury on Valencias, is tentatively attributed to the extreme drought prevailing throughout the summer, broken in March by torrential rains, which afforded favourable conditions for infection of the shrivelled leaves.

In the second contribution, brief notes are given on the symptoms and control of tomato diseases in New South Wales.

Boughey (A. S.). **List of economic plant diseases in the Anglo-Egyptian Sudan. Their appearance, distribution, and control. Including weeds and ornamentals which may serve as alternative hosts for crop diseases.**—44 pp., Dep. Agric. For. Sudan Govt., 1942.

Among the diseases of major importance included in this useful list of economic crop pathogens in the Anglo-Egyptian Sudan may be mentioned broad bean wilt (*Fusarium moniliforme*) [*Gibberella fujikuroi*], coffee rust (*Hemileia vastatrix*), groundnut rosette, potato early and late blights (*Alternaria solani* and *Phytophthora infestans*)

and tuber rot (*Stysanus stemonites*) [*R.A.M.*, xv, pp. 673, 824], and tomato spotted wilt. The presence or absence of a given disease from a particular district is expressed by means of ordinary and Roman numerals, respectively, and a list is given of some common Sudan Arabic names of the hosts with their English or Latin equivalents.

MILBRATH (D. G.). **Bureau of Plant Pathology.** Ex *Rep. Dep. Agric. Calif., 1941* (*Bull. Dep. Agric. Calif.*, xxx, 4), pp. 374–384, 1941.

In this report [cf. *R.A.M.*, xxi, p. 4] it is stated that *Dematophora* [*Rosellinia*] *necatrix* was found in a small area under lucerne in the vicinity of Banning, Riverside County, California [ibid., xxi, p. 23], a first record for the southern part of the State. The infected area was treated with carbon bisulphide at the rate of 4 oz. per 18 in. interval (750 gals. per acre).

The three chestnut plantings infected with *Endothia parasitica* [ibid., xxi, p. 310] were given the two usual annual inspections. A conspicuous decline in the number of affected trees was observed in the two plantings in which treatment has been carried out for seven years, only two and three diseased trees, respectively, being found; in the third planting, where treatment has been given over a shorter period, 14 infected trees were found. Eventually the disease will probably disappear from these plantings. Locally spread is slow, and the perithecial stage has not been found.

The control of western celery mosaic [ibid., xxi, p. 4] by an enforced celery-free period was continued in three separate localities. The principle of the method is based upon the fact that celery plants are the principal source of infection. The carrot is the only other known host that develops the disease in the field, and this crop is grown only very sparsely in the areas concerned, and is harvested in its entirety, no residue of active roots remaining in the ground. With celery, a harvest residue is left in the soil, and there is a rapid succession of crops. Control involves the removal of all vestiges of actively living parts of celery from all fields within the area at a definite time (e.g., 10th August to 10th September under field conditions at Venice). The results have been most outstanding, and have gained the support of the growers for this method.

Operations against peach mosaic [loc. cit.] were continued in co-operation with the Bureau of Entomology and Plant Quarantine. During the year, 653,045 trees on 55,221 properties were inspected, and 3,902 infected ones removed. On 31st December, 1941, 446 old and new cases of infected trees remained standing, and of these 131 were removed in January, 1942, by the owner.

In California, the most destructive vine disease is Pierce's disease [ibid., xxi, p. 278], because of its fatal effect, rapid spread, and widespread distribution. An organized survey by twelve inspectors for 34 man-months showed the condition to be present in 29 of 45 counties surveyed. The highest percentage of infected properties (77·2 per cent.) occurred in Tulare County, which had the second largest area under grapes (65,512 acres). The evidence obtained showed that spread has been very swift in the southern part of the San Joaquin Valley, but less rapid in certain northern counties, such as Rapa. This difference is attributed to epidemiological factors, which will be of first importance when control measures come to be formulated.

Lucerne bacterial wilt (*Phytomonas insidiosa*) [*Corynebacterium insidiosum*] and dwarf [ibid., xxi, p. 278] are both outstanding diseases locally; the former is rather widely distributed in the United States, whereas the latter seems to occur only in California. An organized survey of lucerne dwarf distribution is planned.

WHITE (P. R.) & BRAUN (A. C.). **A cancerous neoplasm of plants. Autonomous bacteria free crown gall tissue.**—*Cancer Res.*, ii, 9, pp. 587–617, 13 figs., 1942.

Secondary or metastatic tumours frequently arise on sunflower plants inoculated with *Phytomonas* [*Bacterium*] *tumefaciens* at considerable distances from the original

neoplasms, the former having been shown by cultural and serological methods to be bacteria-free [*R.A.M.*, x, p. 198]. Tissue cultures isolated from the metastatic tumours on a synthetic agar medium (*Biol. Rev.*, xvi, pp. 34–48, 1941) containing sucrose showed a rapid, disorganized type of growth contrasting sharply with the slow, moderately organized development of those from healthy material. On implantation into uninfected plants of the same or related species (*Helianthus tuberosus*) the bacteria-free tissues induced typical crown-gall tumours. This capacity for unrestrained, invasive, potentially malignant growth, both *in vivo* and *in vitro*, in the absence of the original excitant distinguishes the sunflower metastases from any other plant materials hitherto described and places them in a category comparable to that of cancerous growths in animals.

FLOREY (H. W.) & JENNINGS (M. A.). **Some biological properties of highly purified penicillin.**—*Brit. J. exp. Path.*, xxiii, 3, pp. 120–123, 1942.

The purest preparation of penicillin [*R.A.M.*, xxi, p. 344 and cf. next abstracts] at present available completely inhibits the growth of *Staphylococcus aureus* at a dilution of 1 in 24,000,000 to 1 in 30,000,000. An intravenous injection of 20 mg. of the sodium salt of a rather less highly purified preparation is without apparent effect on a mouse, and human leucocytes survived for an hour in a 1 per cent. solution.

WILKINS (W. H.) & HARRIS (G. C. M.). **Investigation into the production of bacteriostatic substances by fungi. I. Preliminary examination of 100 fungal species.**—*Brit. J. exp. Path.*, xxiii, 4, pp. 166–169, 1942.

The following fungi excited a significantly inhibitory effect on the growth of one or more of the three bacteria, *Bacterium coli*, *Staphylococcus aureus*, and *Pseudomonas pyocyanea*, against which they were tested in a preliminary series of experiments at the University Department of Botany, Oxford: 9 species of *Penicillium*, 16 of *Aspergillus*, *Botrytis cinerea*, *Helminthosporium avenae*, and *Fusarium javanicum*.

WATERS (H. B.). **Report on the Department of Agriculture, Gold Coast, for the year 1941–42.**—7 pp., 1942.

In this report [cf. *R.A.M.*, xx, p. 517] it is stated that during the period under review further surveys showed cacao swollen shoot [ibid., xxi, p. 409], to be present in the Gold Coast in several places west of the Atewa Range, which it had been hoped might form a barrier to the spread of the disease from the east. It was also found on many farms to the east of the large outbreaks at Awenade. Many farms are infected in the Peki area, and several outbreaks have occurred near Wiawso. A large outbreak was found at Kobriso, near the Central Province. The disease has not yet, however, been recorded from Ashanti, the Central Province, or the main Togoland cacao area. To make a complete survey of the disease, all the cacao areas would have to be patrolled, a task which it is estimated would require the services of 20 inspectors and 160 assistant inspectors (who would have to be trained) for a year. In recent surveys, the most expeditious patrolling by one inspector and seven assistant inspectors was 2,000 acres in one week. Even on the scale suggested, patrolling would be unavailing unless treatment patrols, probably consisting of an equal number of men, followed on, cutting out diseased areas. The surveys already made are considered to have served their purpose, by ascertaining what the situation was, and deciding whether treatment could be applied in time to the localities concerned. Isolated outbreaks were treated at Kwabeng, Kwahu, and Awenade, and as the disease is already too firmly established eastwards of Awenade, efforts are being concentrated on preventing spread towards Ashanti and the Central Province.

Surveys of two separate square miles near Mankese and Akodum in the main area of infection revealed that almost 60 per cent. of the cacao farms had died, and over 90 per cent. of the standing old cacao was infected; young standing cacao amounted

to 5 per cent. of the cacao area, and seedling cacao to 1 per cent. Despite this destruction of farms, cacao production is maintained from new plantings in their areas. Spread of infection has been comparatively slow, but the disease is now so prevalent in the main infection area that treatment would be practicable there only if growers would themselves cut out the diseased trees and at least one ring of apparently healthy trees surrounding them. To this they do not appear likely to agree.

The Swollen Shoot Disease of Cocoa Order, 1941 [ibid., xxi, p. 544], provides for the removal of cacao trees from a small strip of land joining North Fomangsu and South Fomangsu Forest Reserve in order to complete a barrier against spread from the Eastern Province to Ashanti.

SĂVULESCU (T.), HULEA (Mme A.), & STĂNESCU (Mlle A.). **Das Vorkommen und die Verbreitung der in Rumänien den Weizenstinkbrand hervorbringenden Tilletia Arten.** [The occurrence and distribution of the *Tilletia* species causing Wheat bunt in Rumania.]—*Phytopath. Z.*, xiv, 2, pp. 148–187, 5 figs., 1 graph, 1 map, 1942.

Wheat bunt in Rumania is caused by four species of *Tilletia*, namely, *T. foetens* [*T. foetida*], *T. tritici* [*T. caries*], *T. triticoides* Săvul. (= 'Typus *triticoides* Gassner'), and *T. intermedia* Gassner (forma '*intermedia*' Gassner = *T. foetida* × *T. caries*) [*R.A.M.*, xvii, pp. 382, 655; xviii, p. 303], of which the first-named predominates, followed by *T. triticoides*, *T. caries*, and *T. intermedia* in the order given. *T. foetida* is particularly widespread in the south and east, where climatic conditions approximate to those of the steppes, while *T. caries* is largely confined to the north and west and to hilly districts, its presence in the Danube Valley, e.g., near Bucarest, being explained by the introduction of wheat selections from the north and west of Europe. The exact geographical distribution of all four species is shown in tabular form and its implications summarized.

T. triticoides, formerly regarded as a type of *T. caries*, is now deemed to merit specific rank [though no technical diagnosis is supplied]. Its spores resemble those of *T. caries* in shape, being spherical or subspherical, but are smaller, the means (for 100 spores) ranging from 16·63 to 18·13 by 15·55 to 17·19 μ. The number and size of the membrane reticulations are similar in both species, but the network is more delicate in *T. triticoides* and the margin slightly undulating. *T. triticoides* is found in association with *T. foetida*, frequently even in the same ears of the plant, though on different seeds; it was not observed to accompany *T. caries*, which in fact it largely replaces in the south of the country. The ears of seven varieties inoculated with *T. triticoides* were found to harbour this species alone, so that there can be no further question as to its homozygotic nature, which is also demonstrated by its morphological and biometrical constancy. The pathogenicity of *T. triticoides* is intermediate between that of the very virulent *T. foetida* and that of *T. caries*, the A. 26 variety being the most susceptible to the first-named (average infection with collections from five provinces 41·3 per cent.) closely followed by Cenad 117 (37·4), and Tigănesti 902 the most resistant (12·7), the reactions of Zemka, Bankut 1201, Odvos 241, and Cooperatorka falling between these limits.

T. intermedia always occurs in the company of either *T. foetida* or *T. caries*; so far it has only been collected in four districts. The spores have a mean size of 16·96 to 17·14 by 15·55 to 16·06 μ and the reticulations are very fine. In the opinion of the author, *T. triticoides* is more likely to be one of the parents of this hybrid than *T. caries*, but his hypothesis needs further substantiation.

LEDINGHAM (R. J.). **Observations on antagonism in inoculation tests of Wheat with Helminthosporium sativum P.K. & B., and Fusarium culmorum (W.G.Sm.). Sacc.**—*Sci. Agric.*, xxii, 11, pp. 688–697, 1942.

In 1940, in field tests at Saskatoon and Indian Head, Saskatchewan, Thatcher

wheat was inoculated with *Helminthosporium sativum* and *Fusarium culmorum*, singly and in combination, using the spore-suspension and oat-hull methods. The results demonstrated that emergence was better when both fungi were combined than when they were used singly. In both localities, this difference was highly significant. The increased emergence (presumably due to antagonistic action between the fungi) was greater when oat-hull inoculation was used than when the spore-suspension method was applied. These results agreed entirely with those obtained in preliminary greenhouse tests.

Growth tests on potato dextrose agar showed that *H. sativum* is quite sensitive to other colonies, either of itself or of *F. culmorum*, though the latter is not inhibited to the same extent. Germination tests were also made, in which conidial suspensions of the two fungi were made up, singly and in combination, and transferred to a slide, so that *F. culmorum* alone, *H. sativum* alone, and the two mixed together were present on each slide. The slides were incubated and counts made of percentage germination. In general, *H. sativum* germinated well alone, as did *F. culmorum*, but when they were combined, the conidia of the latter germinated as well as when alone, while those of *H. sativum* germinated at a greatly reduced rate.

JOHNSON (T.) & HAGBORG (W. A. F.). **Brown necrosis and Alternaria blotch of Wheat.**—*Sci. Agric.*, xxii, 12, pp. 746–760, 1 fig., 1942.

Wheat heads in field plots at Winnipeg have for some years shown a dark discoloration, usually most conspicuous on the outer glumes and lemmas, but also present on the rachides, the internodes (below each node), and, occasionally, the upper part of the peduncle. On the outer glumes, the condition resembles bacterial black chaff, but *Xanthomonas translucens* var. *undulosa* [*R.A.M.*, xxi, p. 447] has not been isolated from affected material. The discoloration on the outer glumes, rachides, peduncles, and internodes was attributed by McFadden to stem rust (*Puccinia graminis tritici*) [ibid., xviii, p. 662]. On the lemmas the condition is associated with *Alternaria tenuis*.

Experimental evidence was obtained which suggested that stem rust may cause discoloration of wheat glumes and the terminal regions of the lemmas while the plant tissues are young and succulent, but that the ability to cause discoloration becomes less as the tissues mature.

Greenhouse tests demonstrated that *A. tenuis* is able to cause melanistic lesions on the lemmas when the conditions approximate to those obtaining in the field. Field experiments clearly showed that *A. tenuis* has considerable ability to discolour the lemmas of wheat varieties derived from Hope or H–44. Its ability to discolour the outer glumes was found to be less marked. Only occasionally was it able to cause discoloration of any other parts. The name *Alternaria* blotch is suggested for the symptom caused by *A. tenuis*.

Under field conditions, floret sterility was produced experimentally by *A. tenuis* in one of three years; sterility due to *P. graminis* resulted only from inoculation by Moore's method [ibid., xv, p. 567]. Greenhouse experiments showed that injured ovaries may serve as infection courts for *A. tenuis*, as may injured areas on lemmas or glumes. The main course of infection, however, is from spores that gain entrance to the inside of the florets, where the presence of dead floral parts favours mycelial growth.

Histological examination of glumes of Renown wheat discoloured by stem rust showed the formation of appressoria and the penetration of entrance hyphae through stomata, but there was seldom any mycelium beyond the substomatal cavity. In the discoloured areas, the cell contents of the parenchyma underlying the stomata on the outer side of the glume were yellow or brown and often much shrivelled. Apparently, the parenchyma tissue is hypersensitive to *P. graminis*; the penetration of the entrance hyphae into the tissue sets up a necrosis (the 'brown necrosis' of

McFadden) distinguished by its brown colour and a tendency to spread for considerable distances along the narrow strips of parenchyma between the vascular bundles.

Examination of Apex and Renown wheat lemmas discoloured by *A. tenuis* invariably showed extensive mycelial growth along the inside surface of the lemma, originating on dead or dying parts. Discoloured areas on the lemmas coincided with the extension of the mycelial growth. In the browned tissue, the cell walls and contents showed dense yellow or brown pigment. In many cases, several layers of cells under the epidermis were collapsed, and so compressed that the lemma thickness was considerably reduced. Mycelium seldom penetrated into the epidermal cells or the underlying tissue. The absence or rarity of mycelium in the discoloured tissue suggests that the cells are killed as the result of the action of enzymes or toxins secreted by the fungus.

Gorlenko (M. V.). Патогенность различных рас **Bact. translucens var. undulosum** для Пшениц. [The pathogenicity of different races of *Bact. translucens* var. *undulosum* to Wheat.]—*C. R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 9, pp. 26–28, 1941.

The pathogenicity of the 13 races of *Bacterium translucens* var. *undulosum* [*Xanthomonas translucens* var. *undulosa*: see preceding abstract], isolated from wheat at the Bacteriological Laboratory of the Pan-Soviet Institute for Plant Protection, was tested in the open at Mitrofanovka, Voronezh district. When the inoculated seeds of wheat variety Cesium 0111 were sown in boxes, all but race 768 produced infection (ranging from 6·6 to 32 per cent.) within 12 days of sowing. The symptoms developing on infected plants included, in addition to those previously described [*R.A.M.*, xvi, p. 91], watery, light green, foliar lesions, which grew, coalesced, and reaching the leaf margin turned white, the leaves breaking off at that stage and their upper parts dying off.

Inoculation of mature plants of Ukrainka, Lutescens 1060/10, and Cesium 0111 with suspensions of nine races of the bacterium produced infection in all cases within 21 to 23 days, the average percentage of infection for the three varieties being 35·1, 56, and 43·3, respectively. In no case was complete blackening of the ears observed and it is concluded that the same picture would obtain following secondary infection in the field, the complete blackening being probably only characteristic of plants grown from infected seed.

Klikov (A. P.). Об источниках инфекции и о локализации возбудителя черного бактериоза злаков. [On the sources of infection and localization of the pathogen of black bacteriosis in cereals.]—*C. R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 1, pp. 15–19, 4 figs., 1941.

A study of black bacteriosis of wheat, caused by *Bacterium* [*Xanthomonas*] *translucens* [*R.A.M.*, xvii, p. 384], was conducted in the Voronezh district of the U.S.S.R. during 1938–9. Petri dishes with agar, after exposure for half an hour in a wheat field at ground-level or at a height of 0·25 m. above it yielded several strains of the organism, identified in microbiological and serological analyses. Dishes placed at 0·5 m. or more above ground remained sterile, probably due to the direct action of the sun rays. When water suspensions of these cultures were inoculated into wheat plants of the varieties Cesium 111, Duimchataya 034 (both susceptible) and Lutescens 062 (resistant), pure cultures of *X. translucens* could be isolated from the infected plants, indicating that the disease can be transmitted by air. The distribution of the causal bacteria in the mature plant tissues was studied in sections stained with safranin—aniline blue with picric acid. The maximum concentrations of bacteria were found inside and around the peripheral vascular bundles, smaller numbers occurring irregularly throughout the plant. It is assumed on the basis of these observations that the plant nutrients passing through the vascular bundles also serve as food for the bacteria; after the breaking down of the bundles by bacterial action,

the nutrients diffuse into the surrounding tissues and are followed by the bacteria. The absence of lignin from severely affected mechanical tissues, which usually turn black, is believed to be due to the action of an acid produced by the bacteria.

WILD (A. S.) & TEAKLE (L. J. H.). **Experiments with micro-elements for the growth of crops in Western Australia. V. Experiments at Kulin (Jilakin) and Bullaring in the southern Wheat belt, 1941.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xix, 2, pp. 71–78, 1942.

It is concluded from the results of further experiments in Western Australia [see below, p. 37] that copper sulphate, or some suitable substitute such as copper ore (mixed with superphosphate), applied to cereal crops at the rate of 5 lb. per acre, will correct copper deficiency in most soils of the wheat belt, 2½ lb. being sufficient for the very light sandy and gravelly types, and 10 lb. necessary for the very loamy and generally superior type of soil. Copper deficiency in wheat may be classified into four degrees of severity as follows: (*a*) very acute: characteristic symptoms appear from four to six weeks after germination, and either the whole plant dies, or only the older leaves, without forming heads; (*b*) acute: few symptoms appear on the leaves until spring (September), then leaf-tipping occurs, stem elongation is retarded, loose heads with pale, sterile florets are formed, and the leaf sheaths turn purplish-grey; (*c*) severe: plants appear normal until early November, but the grain does not mature, and erect dummy heads and discoloured leaf sheaths are general; and (*d*) moderate: the heads contain grain, but are less well filled and bend over on the stalk immediately below the head to a very much greater degree than normal. Experimental data indicate that, where copper deficiency is moderately acute, the weight of grain may be less than 30 per cent. of the net weight of straw and where acute, less than 20 per cent. (normally the ratio may be expected to be from 40 to 70 per cent.). Grain formed in copper-deficient plants is generally somewhat shrivelled and paler in colour than normal. Subterranean clover and lucerne appeared to be fairly reliable indicators of copper deficiency in the soil; oats and wheat, while less reliable, were also of some value.

SURYANARAYANA MURTY (G.). **Segregation and correlated inheritance of rust resistance and epidermal characters in a Barley cross.**—*Indian J. Genet. Pl. Breed.*, ii, 1, pp. 73–75, 1942.

At the Imperial Agricultural Research Institute, New Delhi, an investigation was conducted on the parents of a barley cross, namely, the American variety Alpha (*Hordeum distichon*) and Imperial Pusa 21 (*H. vulgare*), and the F_2 generation of the resultant progeny, the material being collected in the field at the Botanical Sub-Station, Pusa, during the winter of 1937–8. The Alpha parent was characterized by a large number of stomata and epidermal cells per unit area, small size of the stomata, and high resistance to rust (mainly *Puccinia glumarum*), while in the highly susceptible I.P. 21 the number of stomata and epidermal cells was smaller and the dimensions of the stomata larger. In the cross, resistance to rust was found to be inherited along definite Mendelian lines. The anatomical characters (number and size of the stomata and number of epidermal cells), though mutually correlated, were found to be inherited quite independently of rust resistance, plants with widely differing numbers of stomata of highly variable dimensions occurring in all four groups of reaction to the disease from mild to very severe [cf. *R.A.M.*, xi, p. 439; xv, p. 708].

ROSEN (H. R.), WEETMAN (L. M.), & MCCLELLAND (C. K.). **Winter injury as related to fall and winter growth and crown-rust infection in Oat varieties and their hybrids.**—*Bull. Ark. agric. Exp. Sta.* 418, 17 pp., 3 figs., 1 graph, 1942.

During the winter of 1939 to 1940, which was one of the coldest on record in Arkansas, about 6,000 selections of oat hybrids were growing at the main experiment

station, together with all the parent varieties used in hybridizing. Among these parents were some of the hardiest varieties, including Harry Culberson, Custis, Lee, Tennex, Fulwin, and Tennessee 1922, but the percentage of survival for all parents was very small, ranging from 28 for Tennex to 0 for some others. Of the selections, most were no hardier than the parents, and some even less so, but 38 showed 40 to 90 per cent. survival [cf. *R.A.M.*, xix, p. 11].

More than 5,000 selections of individual plants were made from the hybrids that survived the winter and possessed various desirable characters, including resistance to crown rust [*Puccinia coronata*]. Seeds from these were sown in September, 1940, and yields of over 5 tons per acre in green weight were obtained. The selections represented the F_5 and F_6 generations. Good growing weather was experienced, but a severe epidemic of crown rust developed. Every check row (Lee) was affected, infection varying from a trace to more than 50 per cent. On 11th November, the temperature fell to 24° F. and for most of the following six days it was below freezing, dropping as low as 9°. Many of the non-hardy selections and parents succumbed, while the hardier parents showed 35 to 70 per cent. leaf injury, some of it attributable to reduced hardiness due to severe crown rust. Many hardy selections developed appreciably less damage than the hardiest parents, among them being some that made much more growth for winter pasture than the hardy parents and are homozygous for resistance to crown rust, some to crown rust and stem rust [*P. graminis*] and to smuts [*Ustilago avenae* and *U. kolleri*]. The yield of grain of selected strains ranged from 122 to 300 gm. per 5 ft. row compared with 39 to 145 gm. for control rows of the Lee variety, which is considered at present one of the best for the region in question.

Săvulescu (Alice). **Contribuţiuni la studiul boalelor pe Sorghum.** [Contributions to the study of Sorghum diseases.]—*Anal. Inst. Cerc. agron. Român.*, xii, 33 pp., 1940. [Abs. in *Z. PflKrankh.*, lii, 7–8, p. 397, 1942.]

In 1931, 1932, and 1937 the foliage of various species of sorghum in Rumania was damaged by *Bacterium* [*Pseudomonas*] *holci* [*R.A.M.*, xviii, p. 517], which was isolated and successfully inoculated into *Sorghum exiguum*, *S. halepense*, and *S. vulgare*. In 1935, sorghum leaf sheaths bore the lesions of *Bact. sorghi* [ibid., xx, p. 494], which was also inoculated with positive results into the same host. Other factors, however, are believed to be concerned in the development of the latter disease, possibly including an aphid-transmissible virus, as in the case of red stripe in Italy.

Averna-Saccá (R.). **Pustulas pretas sobre Laranjas doces produsidas pelo Phoma citricarpa.** [Black spots on Sweet Oranges produced by *Phoma citricarpa*.]—*Rev. Agric., Piracicaba*, xv, 11–12, pp. 468–474, 3 figs. (1 col.), 1941.

The fungus isolated from the scattered, irregular, black pustules, 1 to 3 mm. in diameter, sometimes converging to form larger lesions (4 to 6 mm.) on sweet oranges purchased in the market of Piracicaba, São Paulo, in August, 1937, produced two kinds of mycelium in pure culture, one chromogenic and the other non-chromogenic, the former secreting a blood-red pigment which diffuses through the medium in cultures of 50 days old and upwards. Both types of mycelium are dimorphic and a distinctive feature of the chromogenic form is its connexion with groups of elongated, fusiform, hyaline, continuous or triseptate cells [resembling *Fusarium* conidia] united by slender, hyaline, terminal or median tubes. Pycnidial production, moreover, is delayed by two months in the chromogenic cultures and is relatively scanty. The pycnidia are globular, dark brown to nearly black, their interior occupied by cylindrical, slender, hyaline, sterigmata in close propinquity, and the pycnospores elliptical or ovoid, hyaline, 9·4 to 13·2 by 4·4 to 8·6 μ, with some individuals measuring 15·4 by 6·5 μ, which would justify the transference of the species from *Phoma* to *Macrophoma*. The pathogen is evidently identical with *P. citricarpa* [*R.A.M.*, xxi, p. 122],

both the Brazilian and Australian forms of which, unlike *P. aurantiiperda* in Italy [ibid., xv, p. 89], are confined to the exterior of the fruits and do not penetrate the underlying tissues. *P. citricarpa* was experimentally shown to be a wound parasite, insect punctures probably providing the normal channels of ingress.

AVERNA-SACCÁ (R.). **Sobre a forma ascofora (Glomerella sp.) que encontrei em algumas folhas de Laranjeira Doce no Guarujá.** [On the ascophorous form (*Glomerella* sp.) encountered on some Sweet Orange leaves in the Guarujá.]—*Rev. Agric., Piracicaba*, xv, 11–12, pp. 463–467, 3 figs. (1 col.), 1941.

Along the coast of São Paulo, Brazil, sweet oranges sustain considerable damage from anthracnose, caused by a species of *Glomerella* which appears to be distinct from *G. cingulata* and is characterized by a septate, branched mycelium, a dense, black stroma, hyaline, ellipsoid conidia (*Colletotrichum* stage distinct from *C. gloeosporioides*), 22 to 37·7 by 4 to 14·8 μ, pointed, 3- to 5-septate, black setae, 140 to 259 by 9·2 to 16·8 μ, developing between the cylindrical sterigmata, quasi-piriform, black perithecia, 148 to 296 by 166 to 296 μ, and clavate, short-stalked asci, 81·4 to 151·4 by 14·8 to 26 μ, containing eight navicular or allantoid, hyaline to light brown, uniseptate spores, 14·8 to 37 by 6·3 to 11 μ. The diseased leaves bear scattered, yellow or dark red-bordered lesions, which may unite to form broad, straw-coloured, brittle areas, sometimes occupying the entire lamina. The branches are similarly affected, while the fruits are covered with irregular, dark-coloured, sunken pustules or dark brown, leathery spots; in a humid atmosphere the entire surface blackens, shrivels, and roughens. Control measures should include the destruction of all infected material, protection against sea winds, liberal supplies of organic manure, phosphates, and lime, and spraying with 1 per cent. Bordeaux mixture as soon as the spots appear.

LOEST (F. C.). **Diplodia and brown-rot gummosis of Citrus.**—*Fmg S. Afr.*, xvii, 197, pp. 517–520, 523, 4 figs., 1942.

In this preliminary account, the author states that for many years past growers in certain parts of the Eastern Transvaal and Eastern Cape Province have suffered heavy losses of citrus trees owing to gummosis due to *Diplodia natalensis* [*R.A.M.*, xxi, p. 128] and brown-rot gummosis caused by *Phytophthora citrophthora* [ibid., xx, p. 401; xxi, p. 195]. As far as is known, *D. natalensis* is confined to the Eastern Transvaal; *P. citrophthora* occurs in both localities, but is a serious menace only in Eastern Cape Province. The diseases affect grapefruit, lemons, and Navel, Valencia, and Cape Seedling orange trees, grapefruit and lemons being most susceptible to *D. natalensis* and grapefruit to *P. citrophthora*.

The symptoms presented by the two diseases differ in some respects. Thus, in attack by *D. natalensis*, the bark in advanced stages is loosely attached to the wood, whereas in advanced stages of *P. citrophthora* infection, it generally remains firmly attached, though small patches may sometimes break away. In such stages, the bark is very light grey to 'very light blackish-grey' when infection is due to *D. natalensis* and drab when it is caused by *P. citrophthora*. Further, with *D. natalensis*, the wood is discoloured like the bark, usually to a considerable depth, and sometimes throughout its full diameter, while with *P. citrophthora* the wood is light dull brown or fawn, to dirty grey, and the discoloration does not generally spread for more than 4 mm. into the wood.

Inoculation experiments proved that *Diplodia* gummosis was caused by *D. natalensis* and brown-rot gummosis by *P. citrophthora*. When pure cultures of the former were inoculated into the trunks or branches of healthy citrus trees, the lesions became self-limited after about eight weeks, and the adjoining tissue began to heal. Only one of ten branches of Triumph grapefruit inoculated with *D. natalensis* succumbed.

Conditions which favour attack by *D. natalensis* include a low nitrogen level

(resulting from over-irrigation, heavy rains, or insufficient application of available nitrogen), over- or under-irrigation, and excessive root cutting during cultural operations; frost and hail injuries are also contributing factors. The main factors likely to conduce to attack by brown-rot gummosis are allowing water to remain in contact with the bark of the trunk for a long period, deep planting, low budding, mechanical injuries to the bark of the trunk, and an inherently poor constitution.

Prevention consists in avoiding these conducing factors. In the case of *Diplodia* gummosis the trees must be supplied with sufficient available nitrogen for normal development. More available nitrogen than is usually given should be applied to trees which have experienced a set-back owing to frost or hail, and to trees which are usually heavy bearers, such as lemons and Triumph grapefruit. The precautions to be taken against brown-rot gummosis are as follows. During irrigation, water must not be allowed to contact the trunk of the tree. Newly planted trees should be irrigated in basins. The bud union must not be too near the soil. Injuries to the bark of the trunk, especially near the base, must be avoided during cultivation. Only trees with a vigorous root system should be planted, and congeniality between root stock and scion is essential.

If, even after preventive methods have been adopted, *D. natalensis* persists, the affected limbs should be cut away, and the exposed surface disinfected. In the case of *P. citrophthora* tree surgery should also be resorted to, or an injection of about 200 c.c. of a solution of methylene blue (1·5 gm. in 1,000 c.c. water) can be made into the trunk just above the lesion.

MILANEZ (F. R.) & JOFFILY (J.). **Estudo sobre a fusariose do Algodoeiro.** [A study of Cotton fusariosis.]—*Rodriguesia, Rio de J.*, v, 14, pp. 325–352, 9 pl., 1941. [English summary.]

The material used in the writers' studies of cotton wilt (*Fusarium vasinfectum*) was obtained from plants of the A.M. 41 variety grown in soil heavily contaminated with aqueous suspensions of the hyphae and spores of the pathogen, the presence of which was verified for the first time in Brazil in 1935 [*R.A.M.*, xvii, p. 35]. In all the sections examined the fungus was detected in the interior of the vessels, and as soon as the vitality of the adjoining tissues declined, they were also invaded by the hyphae. The penetration of the roots through layers of living cells is attributed to the death of the latter from the effects of fungal toxins. The multiplication of *F. vasinfectum* was observed in several regions of the vascular system from the root tracheae up to the leaf veins, the midrib of one of the leaves inspected being so densely infested that some of the vessels appeared to be occluded. The paucity of fungal elements commonly found in the vascular system of diseased plants, however, is in accordance with recent views on the toxic action of *F. vasinfectum*.

Microconidia, 4 to 9·4 by 1·4 to 2·2 μ, were observed, apparently for the first time, in the root tracheae, petioles, and secondary veins of living plants attacked by the wilt disease. The importance of these organs, especially in the leaves, in relation to the spread of infection is emphasized.

When sections of the inoculated plants were mounted in liquid paraffin between the slide and cover glass, the hyphae continued to grow, giving rise to microcultures, macro- and microconidia often developing within 24 hours and chlamydospores in five or six weeks. *F. vasinfectum* would thus appear to share with *Aspergillus flavus* (*Biochemie* [? or *Biochem. Z.*], clv, pp. 356–368, 1925) the property of utilizing liquid paraffin as a source of carbon and energy, and it is suggested that this characteristic may be of value in the diagnosis of cotton wilt and the isolation of its agent.

CRAWFORD (R. F.). **Root rot and its control.**—*Bull. N. Mex. agric. Exp. Sta.* 283, 13 pp., 1941. [Abs. in *Biol. Abstr.*, xvi, 6, p. 1451, 1942.]

In this summary of the present knowledge of *Phymatotrichum omnivorum* in New

Mexico it is stated that in the Mesilla and Pecos valleys rotations of less than three years' duration have proved of little value in the control of the disease [on cotton]. Soil disinfection may be used in small areas where applications of ammonium sulphate alone and in combination with other chemicals are practicable and efficient. Heavy manurial dressings tend to increase the saprophytic micro-organisms in the soil and to inhibit the fungus. Quarantines are employed to prevent spread from infected areas, and local spread is stopped by means of barriers.

Clark (F. E.) & Mitchell (R. B.). **Antibiosis in the elimination of Phymatotrichum omnivorum sclerotia from soil.**—Abs. in *J. Bact.*, xliv, 1, p. 141, 1942.

At Greenville, Texas, uncontaminated, viable sclerotia of *Phymatotrichum omnivorum* survived equally well in sterile, unamended and organic-amended soils. In non-sterile, amended soil, incubation temperatures favouring general microbial activity were more destructive to the sclerotia, 12, 30, 72, and 91 per cent. of which succumbed at 2°, 12°, 28°, and 35° C., respectively; at 28°, soil moisture contents of 35, 58, and 80 per cent. were found to be effective in the order given. Materials with narrow carbon: nitrogen ratios provided equal inhibition of the sclerotia with those of wider ratios less likely to meet good crop nutrient requirements.

King (C. J.) & Presley (J. T.). **A root rot of Cotton caused by Thielaviopsis basicola.** —*Phytopathology*, xxxii, 9, pp. 752–761, 3 figs., 1942.

Thielaviopsis basicola was isolated and identified in 1938 from the purplish-black, rotted vascular tissues of cotton roots collected at Sacaton, Arizona, in 1922 [*R.A.M.*, xix, p. 14], the disease being further observed in 1940 in the Upper Gila River Valley, nearly 200 miles distant from the original focus. In cultures on various standard media the cotton isolates resembled those from tobacco of Tennessee and Missouri origin, though minor differences in the colour and density of the colonies were observed, and on onion agar the cotton strain produced white or buff-coloured sectors which did not develop in the tobacco strain.

Under natural conditions the root rot, which is also characterized by a swelling of the tap-root near the collar, persists in the soil from one year to another, even in the absence of cotton cultivation. The fungus spreads slowly, and the damage caused by it is not ordinarily severe, except occasionally in the spring on American-Egyptian seedlings, which may recover temporarily during the hot weather, the occluded lesions, however, tending to resume activity in the autumn and to destroy the mature plants.

Cross-inoculation experiments with the cotton and tobacco strains of *T. basicola* on Maryland Broadleaf tobacco and Pima cotton were successful, nearly all the inoculated plants showing either external or internal symptoms of the root rot, though only a few died.

Müller-Kögler (E.). **Beobachtungen über das Verpilzen von Forleulenraupen durch Empusa aulicae Reich.** [Observations on the fungal infestation of Pine Noctuid larvae by *Empusa aulicae* Reich.]—*Z. PflKrankh.*, li, pp. 124–134, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 10–11, p. 206, 1942.]

Mass mortality among the larvae of *Panolis flammae* Schiff. resulting from infection by *Empusa aulicae* was observed in the silvicultural district of Tornau (Germany), involving 93·5 per cent. of the total larval population at the end of a three-day epidemic. The infested insects, mostly of the fifth instar, were clinging to the lower sides of the pine needles and had assumed a dirty brownish-green to blackish discoloration.

Pepple (A.) & Fowlkes (W.). **The diagnosis of primary cutaneous blastomycosis (Gilchrist's disease).**—*Virginia med. Mon.*, lxix, 7, pp. 374–378, 5 figs., 1942.

This is a discussion and review of the literature on cutaneous blastomycosis

(*Blastomyces dermatitidis*), with special emphasis on differential diagnosis. The disease is prevalent in the Middle West, notably in the vicinity of Chicago, and a number of cases have been reported from Virginia.

Ray (L. F.) & Rockwood (Ethel M.). **Sporotrichosis: report of a case in which it was resistant to treatment.**—*Arch. Derm. Syph., Chicago,* xlvi, 2, pp. 211–217, 4 figs., 1942.

In the writers' cultures on Sabouraud's agar of *Sporotrichum schenckii* [*R.A.M.*, xx, p. 406], isolated from the arm of a 65-year-old woman at the Massachusetts General Hospital, Boston, the colonies at the end of a month had attained a diameter of 4 cm. and were irregularly furrowed on the dark brown central plateau with radial convolutions towards the buff-coloured periphery. Groups of conidia, varying individually from cigar- to pear-shape and occupied in the middle third by a dark-staining nucleus, were directly attached in rosettes or 'puff-balls', consisting of ten and twenty spores, respectively, to the sides and tips of the slender branching hyphae. This is only the sixth case of the disease to be reported from New England.

Negroni (P.). **El problema de las onixis micóticas no específicas.** [The problem of the non-specific onychomycoses.]—*Rev. argent. Dermatosif.*, xxiv, 1, pp. 194–199, 1940.

The following fungi were isolated from 17 out of 30 cases of onychia studied by the author at the Ramos Mejía Hospital, Buenos Aires: *Trichophyton rubrum*, alone and in association with *Aspergillus sydowi* (which also occurred four times unaccompanied [*R.A.M.*, xx, p. 165]) or unidentified organisms; *T. interdigitale* (five times, always in a pure state); *A. versicolor* in conjunction with *Scopulariopsis* and *Candida parakrusei* in the same patient; *Torulopsis minor* and *Hyalopus onychophilus* [ibid., xi, p. 576] in one case each; and species of *Penicillium* and *Torulopsis*, the latter both alone and accompanied by *Aspergillus* and *Trichophyton*.

Negroni (P.). **Epidemia de tiña en Caballos producida por el Trichophyton flavum.** [An epidemic of ringworm in Horses produced by *Trichophyton flavum*.]—*Rev. argent. Dermatosif.*, xxv, 3, pp. 363–368, 5 figs., 1941.

Attention is drawn to the existence of foci of equine ringworm in Buenos Aires and San Isidro. Material from the eight racehorses examined yielded *Trichophyton flavum*, which was cultured on Sabouraud's honey agar. At the end of a month the cerebriform, pulverulent, chamois-yellow colonies measured 2·5 to 3 cm. at laboratory temperature. Lateral, terminal, or occasionally intercalary, piriform aleuriospores were the only organs produced. Inoculation experiments on guinea-pigs gave positive results.

Negroni (P.). **Sobre un tipo particular de 'onixio blastomicética'.** [On a particular type of 'blastomycetic onychia'.]—*Rev. argent. Dermatosif.*, xxiv, 1, pp. 217–225, 3 figs., 1940. [French and English summaries.]

Descriptions are given of eleven cases of onychia of fungal origin, nine of which presented the peculiarity of being unconnected with paronychia. The causal organisms yielded by five of the aberrant cases were *Candida albicans* (three), *C. zeylanoides*, and *C. chalmersi* [*C. parakrusei*], and by the two typical (1) *C. albicans* and *C. aldoi* [*C. albicans*], and (2) *C. intermedia* and *C. tropicalis* [*R.A.M.*, xx, p. 258].

Pardo-Castello (V.) & Ferrer (I.). **Pinta: mal del pinto; carate.**—*Arch. Derm. Syph., Chicago,* xlv, 5, pp. 843–864, 9 figs., 1942.

In connexion with the recent confirmation by F. Leon y Blanco in Mexico of the spirochaetal origin of 'pinta', 'mal del pinto', or 'carate', a review is given of previous outstanding contributions to the literature on this disease, which was previously

attributed to infection by fungi (including *Aspergillus* and *Penicillium* spp.) [*R.A.M.*, vi, p. 31].

CARRIÓN (A. L.). **Chromoblastomycosis.**—*Mycologia*, xxxiv, 4, pp. 424–441, 6 figs., 1 diag., 1942.

After reviewing the history, geographical distribution, and clinical features of chromoblastomycosis [*R.A.M.*, xx, pp. 164, 202; xxi, p. 289], the author states that repeated observations on many isolates from different parts of the world show that sporulation in the fungi associated with the disease may be of the *Hormodendrum* (*Cladosporium*), *Phialophora*, or *Acrotheca* type. A few of the fungi concerned appear to sporulate by one or other of these methods exclusively, but in most of them at least two occur simultaneously in the individual isolates. The organisms behaving in this manner have been classified as two species of *Fonsecaea*, *F. pedrosoi* (Brumpt) Negroni and *F. compactum* Carrión (represented by one isolate).

The different types of sporulation characteristic of *F. pedrosoi* do not occur in the same proportion in all strains, and the group has therefore been subdivided into a number of varieties in accordance with the predominant method of sporulation [ibid., xx, p. 164].

F. pedrosoi var. *typicus* corresponds morphologically with Brumpt's original description of *H. pedrosoi*. In this fungus, the *Acrotheca*-like sporulation reaches its highest development, the *Hormodendrum* heads are scant, abnormal, or depauperate and the *Phialophora* stage rare or missing. In *F. pedrosoi* var. *cladosporioides*, *Hormodendrum* is the predominant character. In *F. pedrosoi* var. *phialophorica* (originally described as *P. macrospora*) the *Phialophora* method of sporulation predominates, while typical *Acrotheca* heads are produced and *Hormodendrum* is wanting. Lastly, *F. pedrosoi* var. *communis* shows all three methods of sporulation, and includes numerous intergrading forms which represent connecting links among the other three varieties.

As regards the proper generic name for these fungi, differences of opinion exist as to whether it should be *Hormodendrum*, *Phialophora*, or *Fonsecaea*. The objections to the use of *Hormodendrum* are that it would not admit certain isolates of the varieties *typicus* and *phialophorica*, in which the *Hormodendrum* sporulation has become obsolete, and that its application to the species *pedrosoi* has been responsible for most of the confusion. Inclusion in *Phialophora* would be even more confusing. Among the numerous specimens of *pedrosoi* so far studied, only in one does the *Phialophora* sporulation predominate. The author suggests that, as a matter of convenience, *Fonsecaea* is the most suitable name. The genus is legitimate and comprehensive, and covers without strain all varieties of the species *pedrosoi*. It represents a mycologic group possessing distinct pathogenic properties.

The *phialophorica* variety is accordingly named *F. pedrosoi* var. *phialophorica*, with a Latin diagnosis, synonyms being *P. macrospora* [ibid., xvi, pp. 38, 251], *P. verrucosa* [ibid., xix, p. 406], and *Acrotheca pedrosoi* [ibid., xx, p. 164].

RÖDER (K.). **Einige Untersuchungen über ein an Hanf (Cannabis sativa L.) auftretendes Virus.** [Some investigations of a virus occurring on Hemp (*Cannabis sativa* L.).]—*Faserforsch.*, xv, pp. 77–81, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 10–11, pp. 195–196, 1942.]

For some years past hemp on low-lying moorland soils in Germany has been affected by a foliar chlorosis believed to be due to a virus. Diseased stalks are noticeably smaller and thinner than those of healthy plants and the yield of seed is appreciably lower. The disorder is communicable from infected to healthy plants by means of expressed juice, but the symptoms thus induced are atypical. The seeds of diseased plants are reported to give rise to chlorotic progeny. On the basis of the

normal ratio of one male to one female plant twice as many diseased individuals were counted among the latter as in the former sex.

JENKINS (ANNA E.) & TILFORD (P. E.). **Pedicel necrosis of the Rose.**—*Amer. Rose Annu., 1941*, pp. 180–181, 1 fig. (facing p. 91), 1941.

Pedicel necrosis was first observed by F. Weiss about ten years ago in the District of Columbia on the Radiance variety, and later in the same season by the senior writer on Red Radiance. In July, 1940, the disease was prevalent on both varieties in Ohio, and reports of its occurrence have also been received from New York, New Jersey, and Oregon. The decay is associated with a bending of the pedicel in a more or less even curve and a consequent drooping of the blossom, which slowly withers, remaining about half open for several days before the petals fall. The first symptom of the necrosis is a reddening of the portion of the pedicel most exposed to the sun's rays, the resultant lesion sometimes expanding to girdle the stem for an inch or more. The affected area, which assumes a striking, often purple, discoloration, appears to comprise only a few outer cells. Below the node the stem remains green. The second (September) crop of roses on the same plants in Ohio were free from pedicel necrosis, though some drooping was still observed. No evidence of fungal involvement was obtained from cultures of the affected tissues.

LYLE (E. W.). **Texas black-spot control work.**—*Amer. Rose Annu., 1941*, pp. 172–175, 1941.

In 1940, at the Tyler branch of the Texas Agricultural Experiment Station, the following percentages of rose black spot [*Diplocarpon rosae*: *R.A.M.*, xix, p. 348] control on the Caledonia variety were given by seven applications of the following fungicides: cupro-K spray (copper oxychloride) 4 lb. to 50 gals. water plus an equal amount of wheat flour, 95; cuprocide 54 Y spray (cuprous oxide) 3 lb. to 100 gals., 89; mike sulphur spray, 48; and sulphur-copper dust (90 per cent. Spider brand sulphur plus 10 per cent. cuprocide GA), 76. The gain in weight of plants treated with sulphur-copper dust amounted to 113 per cent. In another test with the same preparation in a plot of 164 Hybrid Teas of several susceptible varieties, the number of diseased leaflets per plant on 1st October (after 18 applications with a hand duster delivering 17·3 lb. per 100 plants) was only 1·1 compared with 4 on 16th April, when the first treatment was made.

LYLE (E. W.) & MASSEY (L. M.). **Die-back of Roses.**—*Amer. Rose Annu., 1941*, pp. 176–178, 3 figs., 1941.

'Die-back' is not a specific disease of the rose, but may be part of the symptom complex of winter injury, deficiencies or excesses in the supply of nutrient elements or water, or the indirect sequel to cankers (*Cryptosporella umbrina* and *Coniothyrium fuckelii*) or other agencies tending to lower the vigour of the plants. Defoliation due to black spot [*Diplocarpon rosae*] or other causes may predispose the host to infection by normally saprophytic fungi, notably *Diplodia* spp. [*R.A.M.*, xix, p. 348]. In an experiment at Tyler (eastern Texas) in which half the bushes of the Margaret McGredy variety were protected from rain by a glass covering and the remainder left exposed, the former remained free from black spot, while the latter contracted severe infection followed by defoliation and die-back. Other varieties highly susceptible alike to black spot and die-back are Mrs. Pierre S. du Pont, Souvenir de Georges Pernet, and Mrs. A. R. Barraclough, whereas resistance to both diseases has been shown by Radiance, Étoile de Hollande, Edith Nellie Perkins, and Lady Hillingdon.

DIMOCK (A. W.). **Controlling Septoria leafspot of the Chrysanthemum.**—*Bull. Chrysanth. Soc. Amer.*, x, 1, pp. 6–11, 1942. [Abs. in *Chem. Abstr.*, xxxvi, 17, p. 5309, 1942.]

The results of two years' experiments indicate that chrysanthemum leaf spot

(*Septoria*) [*chrysanthemella*: *R.A.M.*, xix, p. 475] is entirely amenable to control by well-timed and thorough applications of 4–4–100 Bordeaux mixture, Grasselli copper compound A (copper oxychloride) [ibid., xxi, p. 245] at a dosage of 2·36 lb. in 100 gals. water, or C–O–C–S (copper oxychloride sulphate), 1·89 lb. in 100 gals. Fungisul (a wettable sulphur, used at the rate of 3 lb. in 100 gals.), and spergon (2 to 6 lb. in 100 gals.) were slightly less effective, but the former is recommended, either as a supplement to, or in place of, the copper-containing preparations where rust [*Puccinia chrysanthemi*] or mildew [*Oidium chrysanthemi*] presents a problem.

Kendrick (J. B.) & Baker (K. F.). **Bacterial blight of garden Stocks and its control by hot-water seed treatment.**—*Bull. Calif. agric. Exp. Sta.* 665, 23 pp., 6 figs., 1942.

A bacterial blight of garden stocks (*Mathiola* [*Matthiola*] *incana*) is reported to have occurred in commercial seed and cut-flowers plantings and in home gardens in the coastal areas of California since 1933, causing death or stunting of many plants and serious reduction or even total loss of the seed crop in some seasons. The disease is characterized by a soft, water-soaked condition of the main stem and growing-tip and a general collapse in young seedlings, and by dark, sunken lesions on the main stem and lateral branches in older plants, followed sometimes by death through girdling. The causal organism, named by the author *Phytomonas incanae* n.sp., resembles closely *P.* [*Xanthomonas*] *campestris*, to which apparently the same disease has been attributed in Tennessee [*R.A.M.*, xi, p. 517] and New South Wales [ibid., xxi, p. 291], but differs from it in that it produces neither acid from maltose and l-arabinose in synthetic media, nor indol; does not reduce starch; and varies very slightly in cell measurements. The main difference, however, lies in their pathogenicity, the new species failing to infect cabbage or cauliflower plants in the greenhouse while inducing typical symptoms on stocks and *X. campestris*, on the other hand, failing to induce infection in stocks. The disease was easily reproduced in the greenhouse by spraying a water suspension of the bacteria on young plants with and without wounding the stem tissue. The causal organism was recovered from the vascular system of all parts of the plant and is seed-borne. The disease in stocks was partly controlled in the greenhouse and greatly reduced in the field by immersion of the seed (preferably in small amounts in loose cheese-cloth bags) in water at 53° to 55° C. for ten minutes followed by prompt cooling in cold water. The treated seed can be stored for several months. Field evidence indicates that the causal bacterium persists in the soil, which it is advisable therefore to sterilize with steam or to drench to a depth of 6 in. with a 1 in 50 solution of formaldehyde. A two- to three-year rotation is also advocated. The disease can be spread by drainage water and by land-levelling operations.

Milbrath (D. G.). **Probable virus disease of Pittosporum daphniphylloides.**—*Bull. Dep. Agric. Calif.*, xxix, 3, pp. 158–159, 1 fig., 1940. [Received November, 1942.]

Pittosporum daphniphylloides plants growing near Chico, California, were observed to show a strong mosaic mottling of the young leaves, the pattern consisting of dark green, irregular, frequently raised areas surrounded by light yellowish-green. The affected leaves were asymmetrical, with irregular margins. Occasionally, the lamina on one side of the midrib was about a quarter of the size of that on the other. The leaves of affected plants were shorter and narrower than those of normal plants, and the diseased plants were, as a whole, dwarfed. Patch bark grafts from affected plants to three healthy plants gave characteristic symptoms on one plant, indicating that the disease is due to an infectious, transmissible virus.

Vanterpool (T. C.). **Pythium root rot of grasses.**—*Sci. Agric*, xxii, 11, pp. 674–687, 8 figs., 1942.

During the last few years there has been an increase in the grass acreage for hay

and seed and in seeded pasture in the Canadian prairies, with the result that the question of grass diseases and their possible effects on subsequent crops in the rotation has become important. In this paper the author deals with investigations on *Pythium* root rot of grasses, supplementing those of the same writer and his collaborators on browning root rot of cereals (*P.* spp.) in Saskatchewan [*R.A.M.*, xix, p. 696]. In the early summer of 1941 the author isolated strains of *P. aristosporum*, *P. arrhenomanes*, and *P. graminicola* from lesions in the root of brome grass (*Bromus inermis*), crested wheat grass (*Agropyron cristatum*), and slender wheat grass (*A. pauciflorum*) growing on farms in north-central Saskatchewan. All these species were ascertained experimentally to be highly pathogenic to wheat seedlings, on which they produced a severe brown necrosis of the roots. *P. tardicrescens* and *P. volutum* are also of major concern to grasses and cereals. Strains of *P. de Baryanum* and close allies, obtained at the same time, were slightly to moderately pathogenic to wheat under the same conditions. Evidence obtained also indicated that *Pythium* damage to cereals and grasses is as common and serious in North Dakota and the adjoining States as it is in Saskatchewan [ibid., xxi, p. 366].

Pythium damage to grasses is of four types: a pre-emergence killing of the seedlings, in which both roots and shoots are attacked; damping-off or early seedling-killing, resulting from rotting of the roots and stem bases; lesions of the coarser roots and invasion of many of the fine laterals in the late seedling stage; and lesions of the new batches of roots produced on perennial grasses during later growth periods. The first two types cause reduction of stand, but the damage in the aggregate caused by types three and four may also be considerable. The pre-emergence and damping-off types of injury seldom occur on cereals in Saskatchewan.

All cultivated grasses in Saskatchewan are attacked. Millet (*Setaria italica*) and sorghum are highly susceptible. An experiment was conducted in which brome grass, crested wheat grass, slender wheat grass, lucerne, sweet clover (*Melilotus alba*), and flax were grown in the greenhouse in pots containing soil from wheat fields heavily infested with *Pythium* browning root rot and in other pots containing healthy soil. The dry weights of the plants in the infected soil were found to be 57·5, 46·9, 82·9, 66·6, 101·2, and 92·9 per cent. of those for the plants in healthy soil, for the different host species, respectively. In a second experiment the corresponding figures were 76·2, 58·4, 44·9, 56·7, 82, and 118·4 per cent.

In another experiment, brome, crested wheat, and slender wheat grasses were grown in *Pythium*-infested, steam-sterilized infested, and normal soil maintained at 30 and 60 per cent., respectively, of the moisture-holding capacity. The averages of germination for all three hosts together in the three different soils at 30 per cent. moisture capacity were, respectively, 68·6, 78, and 64·5 per cent., and at 60 per cent. moisture capacity 70, 86·6, and 68·5 per cent., the corresponding figures for the dry weights being 3·78, 12·05, and 8·69 gm. and 10·92, 19·45, and 13·08 gm., respectively. The large increase in growth and germination in the steam-sterilized over the infested soil is due to the increase in nutrients and the destruction of root-destroying fungi in the steamed soil. Apparently the factors limiting yield were more effective in the dry than in the moist soil.

The effect of various fertilizers on grasses grown in *Pythium*-infested soil under greenhouse conditions showed that phosphate-containing fertilizers, especially ammonium phosphate (11–48), increased growth considerably. Ammonium sulphate alone under the same conditions was without effect or slightly deleterious.

It is tentatively suggested that if grasses are to be grown on fields where severe browning root rot of wheat has occurred, and where economical increases in yield have resulted from phosphatic fertilizer amendments, at least trial-strip applications of ammonium phosphate should be made.

CORMACK (M. W.). **Varietal resistance of Alfalfa and Sweet Clover to root and crown rotting fungi in Alberta.**—*Sci. Agric.*, xxii, 12, pp. 775–786, 1942.

The results are given of seven years' field tests at different localities in Alberta to determine the resistance of all available hardy varieties and strains of lucerne and sweet clover (*Melilotus alba*, *M. officinalis*, and *M. suaveolens*) to crown- and root-rotting fungi.

The pathogens attacking dormant plants of these two hosts in early spring are, in descending order of destructiveness, the low-temperature Basidiomycete [*R.A.M.*, xxi, p. 143], *Cylindrocarpon ehrenbergi*, *Sclerotinia sativa* Drayton & Groves [a description of which is expected to appear in *Mycologia*], and *Fusarium avenaceum*. Similarly, the fungi attacking growing plants of sweet clover are *Phytophthora cactorum*, *F. culmorum*, *F. avenaceum*, and *S. sativa*. Lucerne was much more resistant than sweet clover to all these organisms, except the low-temperature Basidiomycete.

Of the lucerne varieties tested for resistance to *C. ehrenbergi* and *S. sativa*, the most resistant was *Medicago falcata*, the Cossack and Viking varieties coming next, but probably only slightly above the others, including Grimm. *M. falcata*, Cossack, and Viking may possibly possess some resistance to the low-temperature Basidiomycete, but all varieties of sweet clover appear to be highly susceptible.

Of the sweet clover varieties tested for resistance to *S. sativa* those belonging to *Melilotus alba* were more susceptible than those belonging to *M. officinalis*. Redfield Yellow (*M. suaveolens*) was only slightly less susceptible than varieties of *M. alba*, but it showed some resistance to *C. ehrenbergi* as did the Arctic variety of *M. alba*.

A strain of Alpha sweet clover (S 30–35–1–8) developed at Saskatoon was highly resistant to *P. cactorum*.

ANDERSON (A. J.). **Molybdenum deficiency on a South Australian ironstone soil.**—*J. Aust. Inst. Agric. Sci.*, viii, 2, pp. 73–75, 3 figs., 1942.

Ironstone soils in the Meadows area of South Australia have for many years failed to produce satisfactory yields of pasture, even with the addition of superphosphates. Improvement, however, always results when timber is burnt on the ground, or when wood ashes are applied to the pasture. Lime and other alkaline earths very slightly improved the yields, but copper, manganese, zinc, boron, iron, and potash (singly and in various combinations) failed to effect any improvement.

In 1941, ammonium molybdate at the rate of 1 lb. per acre was added to a mixture of the above-mentioned six elements and applied to a seeded pasture of subterranean clover [*Trifolium subterraneum*], perennial rye-grass [*Lolium perenne*], and *Phalaris tuberosa* in plots; the yield of *T. subterraneum* amounted to 26·63 cwt. dry matter per acre, as against 1·93 to 2·74 cwt. for other treatments.

A test was then made with the same soil in pots, when it was shown that molybdenum applied as sodium molybdate at the rate of 2 lb. per acre increased the yield of lucerne [*R.A.M.*, xxi, p. 336] from 1·6 to 3·13 gm. dry matter per pot. The leaves of the molybdenum-treated plants were dark green, while those of the remainder were yellowish to pale green. In a second series of pot cultures 1 lb. per acre of sodium molybdate markedly increased the development of subterranean clover.

LEFEBVRE (C. L.). **Claviceps yanagawaensis in imported seed of Japanese Lawn Grass.**—*Phytopathology*, xxxii, 9, pp. 809–812, 2 figs., 1942.

Japanese lawn grass (*Zoysia japonica*) seed imported into the United States in 1939 was found to contain a high percentage of sclerotia of *Claviceps yanagawaensis* Togashi, hitherto unknown in the country. They measured 0·25 to 1·5 by 0·5 to 1 mm. and were of a greyish-violet colour, sometimes with a superficial yellowish-green gloss, flattened, usually somewhat curved and nearly always entangled with the shiny, flattened, indurated glumes of the host. Germination was ordinarily

effected by the production of a single stroma from the apical third of the sclerotium, but under certain conditions more stromata may develop. The stipe length in the specimens examined by the writer (4 to 16 mm.) exceeds the corresponding measurement given by Togashi, while the width in the former (0·3 to 0·5 mm.) falls slightly short of the Japanese dimensions (*Trans. Sapporo nat. Hist. Soc.*, xiv, pp. 280–285, 1936), but the figures for the heads (0·3 to 1·0 by 0·4 to 1·5 mm.), perithecia (180 to 320 by 70 to 190 μ), asci (85 to 165 by 4 to 8 μ), and ascospores (75 to 135 by 1 to 2·25 μ), respectively, cited for *C. yanagawaensis* in its native habitat agree well with those of the imported material.

The immersion of infected *Z. japonica* seed in a 75 per cent. solution of sulphuric acid for 20 to 30 minutes destroyed the ergot sclerotia and simultaneously improved the germination of the grass, from which it would appear that seed so treated may safely be distributed for planting.

A rye hybrid known to be highly susceptible to *C. purpurea* was inoculated with the ascospores of *C. yanagawaensis*, but no infection resulted.

Garber (R. J.) & Chilton (S. J. P.). **The occurrence and inheritance of certain leaf 'spots' in Sudan Grass.**—*J. Amer. Soc. Agron.*, xxxiv, 7, pp. 597–606, 4 figs., 1942.

Details are given regarding the heritable nature of leaf spots occurring on selfed lines of Sudan grass (*Sorghum vulgare* var. *sudanense*) grown in the nursery at State College, Pennsylvania, in 1941. No micro-organisms could be isolated from the foliar spots, which may be responsible for considerable damage, destroying large areas, particularly of the lower leaves. Apart from the colour factor, the inheritance of the leaf spots appears from the F_2 and F_3 data of crosses involving three types of the disorder to be complex, the lesions varying in size, shape, number, and time and place of development on the host.

Moore (M. H.) & Steer (W.). **The East Malling Spray Calendar, 1942 edition.**—*Rep. E. Malling Res. Sta., 1941*, p. 68, 1942.

Notes are given on the new edition (for 1942) of the East Malling Spray Calendar for fruit and hops, the Calendar itself being appended to the Report. This is a completely new version, in which almost all the recommendations originally made when the Calendar was first issued, eight years ago, have been modified.

Wormald (H.). **The grey mould of fruit and Hops. Weeds as possible sources of infection.**—*Rep. E. Malling Res. Sta., 1941*, pp. 44–47, 1942.

During the first fortnight of June and the first half of the autumn, 1941, grey mould (*Botrytis cinerea*) [*R.A.M.*, xx, p. 169] was widely prevalent in south-eastern England on many cultivated plants and weeds. It was particularly abundant on the flower heads of Compositae, including the sow thistles *Sonchus arvensis* and *S. oleraceus*, which make vigorous growth if left undisturbed in cultivated ground. The practice of allowing weeds to grow, so that they can be ploughed in as a cover crop, is inadvisable if there are valuable crops in the vicinity susceptible to grey mould, such as fruit, hops, field beans, or lettuce. In such cases, a recognized cover-crop mixture is to be preferred. Not all cover-crop plants are immune from *B. cinerea*, since a few fructifications have been found on the flower-heads of red and white clover [*Trifolium pratense* and *T. repens*], petals of common vetch, and the pods and flower-stalks of lucerne. These, however, are much less susceptible than some of the composite weeds, especially the sow thistles. Crops that admit of clean cultivation should be kept as free from weeds as possible, particularly bush fruit, hops, field beans, and vegetables, and if a cover crop is required for humus production a cover crop seed mixture should be sown.

WORMALD (H.). **Notes on plant diseases in 1941.**—*Rep. E. Malling Res. Sta., 1941*, pp. 40–42, 1942.

These notes [cf. *R.A.M.*, xxi, p. 24] contain the following items of interest. In June, 1941, twigs of *Pyrus japonica* from a garden near Maidstone were received showing clusters of dead flowers bearing numerous pustules of *Monilia cinerea* [*Sclerotinia laxa*]. Apples, mostly of the Grenadier variety, showing the black-apple condition while still on the tree, were infected by *S. fructigena* [ibid., vi, p. 37]. One case of severe pear canker due to *Nectria galligena* was observed on young trees. A few yards away, some badly cankered apple trees were found, from which the infection appeared to have spread to the pears, those nearest the apples being the most severely affected. When young apple or pear trees are planted, all cankers should be removed from older trees in the vicinity before the young trees are pruned.

Bacterial blossom blight of pears [?*Pseudomonas prunicola*: ibid., xxi, p. 25] was very destructive in Kent and other parts, all or most of the blossom on some trees being destroyed.

Plum leaves severely attacked by rust [*Puccinia pruni-spinosae*: ibid., xix, p. 418] were received from various localities in southern England, with complaints of serious premature leaf fall in some instances. Attempts at control should be made in areas where the disease is serious every year, by removing anemones showing the cluster-cup stage from gardens in the vicinity of plum orchards and spraying the trees with Bordeaux mixture when the fruit is about half-grown, and again (if the disease appears to be spreading) immediately after picking [ibid., xx, p. 369; xxi, p. 244].

COOLEY (J. S.). **Wound dressings on Apple trees.**—*Circ. U.S. Dep. Agric.* 656, 18 pp., 2 diags., 4 graphs, 1942.

A full account is given of experiments carried out at Hood River, Oregon, from 1929 to 1931, and from the latter year until 1938 at Arlington, Virginia, to determine the relative merits of a number of wound-dressings for the protection of the limbs of mature apple trees against invasion by the perennial canker fungus, *Neofabraea perennans* [*R.A.M.*, xix, p. 226]. Internodal or side wounds made at monthly intervals for two years were treated with two wax-like dressings, Nos. 540 and 541, white lead and linseed oil, and shellac, of which the last-named induced more extensive callus formation and less dying or longitudinal extension of the injury than any other preparation used. Generally speaking, dressing No. 541, consisting of eight parts of rosin and three of sardine oil, proved superior in healing properties to No. 540 (seven parts rosin and three each of sardine oil and copper soap) or white lead and linseed oil, and was further effective against the depredations of the woolly aphis (*Eriosoma lanigerum*).

ISAAC (W. E.). **The incidence of superficial scalds in Apples grown in South Africa in relation to storage temperatures.**—*J. Pomol.*, xx, 1–2, pp. 12–23, 3 graphs, 1942.

Two types of scald are distinguished on six South African apple varieties held at different storage temperatures [*R.A.M.*, xx, p. 51], viz., 'superficial', roughly corresponding to the 'scald', 'apple scald', and 'superficial scald' of previous workers but also including dirty grey or green, light to medium brown or dark discolorations; and 'frigescence superficial', characterized by medium brown discoloration diffused over the surface, the former tending to develop late in the storage period on Ohenimuri, Granny Smith, and White Winter Pearmain at relatively high temperatures (3·3° to 7·2° C.), and the latter on Red Delicious, Granny Smith, and Wemmershoek at low ones (—1·7° to 1·1°) though not necessarily increasing in prevalence and intensity with fall of temperature over this range. The character of the defect on Rome Beauty did not conform to either of these types, being prevalent at all the storage temperatures employed except —1·7° with a tendency to greater severity, more particularly of the spotted form of it, at the higher range. Pre-storage conditions

are thought to affect the development of scald in this variety to a greater extent than is the case with the others.

The spotted superficial scald of Rome Beauty agrees in some respects with Jonathan spot, from which it differs, however, in its restriction to the later storage period, the latter disorder developing early, sometimes even while the fruit is still on the tree, and in the absence of underlying tissue necroses. Frigescence superficial scald presents certain analogies with soft scald [ibid., xix, p. 479] and internal browning of Yellow Newtowns [ibid., iii, p. 403]. Soft scald may indeed be a very severe but more localized form of frigescence superficial scald. The temperature relations of the two disorders are similar and tests with oiled wrappers showed that these had little or no effect on the incidence of soft scald and varied in effectiveness against frigescence superficial scald, though they were generally useful in eliminating or reducing this disorder. The fact that the severity of internal browning of Yellow Newtowns increased with decreasing temperature from 7·2° to —1·1°, while it was not serious at or above 7·2°, suggests a closer affinity to frigescence superficial than to superficial scald.

WELSH (M. F.). **Studies of crown rot of Apple trees.**—*Canad. J. Res.*, Sect. C, xx, 9, pp. 457–490, 5 figs., 1942.

Crown rot is stated to be of considerable economic importance in the irrigated apple orchards of the Okanagan Valley, British Columbia, where it attacks all commercial varieties at all ages. The rot is usually confined to those portions of the trunk and roots that lie within 6 in. of the ground-level, and spreads very rarely below 9 in. or above-ground. The rot may girdle a large tree and spread several feet along the surface roots in the course of a few weeks, or it may cease to spread entirely after producing a small patch or girdling one single root. Not infrequently trees were observed to lose one or two small roots each year, but never to suffer extensive damage. The rot is not apparent unless the tough outer layer of bark is scraped off, exposing the brown and soft remaining layers down to the cambium, beneath which there is no evidence of rotting. Recently rotted tissues are light yellow-brown, and old infections a darker brown, no definite margin being formed, except where the spread of the rot has ceased. In the rare cases where the rot spreads to above-ground tissues, a zonate effect is produced by alternating layers of very light brown and darker brown tissues of a firm, soapy consistency, and sometimes patches of liquid exudate appear just above the upper margin of the rotted bark. Secondary symptoms in the upper part of the tree appear after the rot has progressed for some time and comprise bronzing and yellowing of the older and dwarfing of the newly formed leaves, a reddish tinge of the bark, and small and conspicuously coloured fruits. When infection occurs in the early part of the summer, these symptoms develop in the same year, reappearing in a more pronounced form in the following spring, accompanied by a reduction of terminal growth; when the disease occurs late in the growing-season, the entire sequence of symptoms develops only in the second year.

Phytophthora cactorum was isolated from rotted tissues and produced, upon inoculation, typical crown-rot symptoms in 58 bearing and 50 one- and two-year-old apple trees in the field and in 93 two-year-old trees in the greenhouse. Isolation of the fungus proved somewhat difficult and was only possible from the tissues at the margin of active lesions. Evidence is adduced that the fungus is inhibited by bacteria, (in particular strain 452 b) in all but the marginal region. An alternative explanation of the difficulty of isolating *P. cactorum* might be that degradation products of dying host tissue are toxic to the fungus.

Field observations and the results of inoculation of two-year-old trees under controlled conditions in Wisconsin tanks in the greenhouse showed the disease to be favoured by high temperatures and high soil moistures. Thus, the incidence of the disease was highest at a soil moisture of 96 per cent. saturation at the highest tempera-

ture imposed, 32° C.; a reduction of soil moisture to 60 per cent. at the same temperature reduced the severity of the disease from 100 per cent. to zero. The effect of soil moisture was more prominent in the subsoil than in the locus of crown-rot attack, operating apparently as a factor predisposing the tree to infection. The results of field inoculation experiments indicated that initiation and spread of crown rot are discouraged when surface soil moisture levels fall below 25 per cent. of saturation. In cultural studies, the growth rate of *P. cactorum* increased steadily with the rise in temperature from a minimum of between 4° and 6·5° to 27°; the maximum temperature was about 32°, and death resulted from eight days' exposure to this temperature. The fungus was unable to survive desiccation in culture. A varying degree of resistance was evident in varietal tests. Dormant trees generally displayed a greater degree of resistance than those in active growth, the appearance of the disease in such trees being delayed and the spread slow. The presence of wounds proved essential for successful inoculation. Comparison of *P. cactorum* isolated from trunk cankers from Indiana [*R.A.M.*, xviii, p. 809] with those from crown rot disclosed hardly any differences in cultural characteristics or morphology; but the two isolates seemed to differ somewhat in their pathogenicity to various apple varieties, suggesting possible strain differences.

The principal recommendations for the control of crown rot, practised so far in British Columbia with partial success, include an examination of the crowns of all suspected trees in late summer and the removal of all rotted bark in the following spring, leaving the diseased crowns exposed until late autumn; the removal of girdled trees; the inarching of suckers or young seedling trees above the scarified lesions of partially girdled trees; and, finally, the reduction of irrigation to the minimum and the drainage of low-lying orchards. The present investigations have confirmed the necessity of reducing soil, especially subsoil, moisture, and stress the importance of avoiding wounds.

Ark (P. A.). **Control of crown gall of Peach in the nursery.**—Abs. in *Phytopathology*, xxxii, 9, p. 826, 1942.

Ceresan, mercuric cyanide, and mercuric iodide dusts, mixed with celite 500 at the rate of 15 gm. to 450 gm. and applied to well-washed peach pits [? in California], reduced the incidence of crown gall [*Bacterium tumefaciens*] from over 99 to 3·8, 13·9, and 4·3 per cent., respectively. Acidification of the soil by the admixture of sulphur lowered the P_H value from between 7 and 8·5 to 5 or 5·5, at the same time inducing a decrease of 20 to 30 per cent. in the amount of crown gall. Applications at the rate of 500 or 1,000 lb. per acre were harmless to the plants, but 2,000 lb. caused yellowing and stunting.

Hildebrand (E. M.). **Prune dwarf.**—*Phytopathology*, xxxii, 9, pp. 741–751, 5 figs., 1942.

Prune dwarf (prune virus 6 or *Nanus pruni* H.), originally reported only from Niagara County, New York [*R.A.M.*, xvi, p. 330], has since been observed in Canada [ibid., xxi, p. 146], where two severe attacks occurred on damson plums top-worked to the susceptible Italian (Fellenberg) prune. Both damson and Bradshaw plums may carry the virus in a masked form. The spread of infection is normally restricted to the immediately adjacent trees in an orchard, with occasional skips, suggesting the agency of an insect vector with a short flight range, possibly the green plum aphis [*Myzus mahaleb*], but insect transmission experiments have hitherto only yielded negative results. The fruit yield of affected plums of the prune type is much reduced, averaging less than 10 per cent. of the normal, whereas in Lombard, which sustains only foliar damage without abortion of the pistils, the drop is only slight, and the symptomless damson produces a normal crop.

The disease was successfully transmitted by bud-, cleft-, and whip-grafting from

Italian prunes to other varieties of the same type, in which the symptoms included severe foliar dwarfing and a light fruit set, and to Lombard (leaves only affected); Bradshaw and Reine Claude reacted very slightly, and the results obtained with *Prunus salicina*, Abundance, and Burbank were inconclusive or negative. Three separate lots of dormant Red June trees developed a line-pattern mottling [ibid., xxi, p. 146] in the greenhouse. Negative results were given by transmission tests from prune to cherry, whereas Elberta peaches responded to inoculation by temporary foliar symptoms resembling those of rosette [ibid., xxi, p. 371] and retarded fruit growth, especially on the suture side.

Richards (B. L.) & Hutchins (L. M.). **The western 'X' disease of the Peach in Utah: its etiology and significance.**—Abs. in *Proc. Utah Acad. Sci.*, xviii, pp. 13–14, 1941.

Western 'X' disease [*R.A.M.*, xxi, p. 260], first observed in northern Utah on *Prunus demissa* in 1937 and on the peach in 1939, is now known to occur in a severe form in five counties of the State, the peach industry of which is seriously threatened. Up to 80 per cent. infection has been observed, the maximum incidence being found in older orchards. In 1939, 23·8 per cent. of the trees in orchards of all ages were diseased, and in 1940, infection was present in 36·7 per cent. of the trees in 14 six- to twenty-year-old orchards, the spread of the virus between 1939 and 1940 in twelve orchards ranging from 2·7 to over 300 per cent. A comparable rate of diffusion has been noted in *P. demissa*, diseased plants of which have been seen along the foothills running parallel with the peach-growing areas from Brigham City in the north to Salt Lake City in the south. The incubation period of the virus, grafted from diseased to healthy peaches, ranges from five weeks to sixteen months. Intercommunicability between peach and *P. demissa* has not been established.

Massee (A. M.). **Aphis transmission of Strawberry crinkle in Great Britain.**—*J. Pomol.*, xx, 1–2, pp. 42–47, 1942.

Details are given of experiments at the East Malling Research Station in 1937, 1938, and 1941 on the transmission of strawberry crinkle by means of the aphid, *Capitophorus fragariae* [*R.A.M.*, xxi, p. 380]. Mild symptoms of the disorder developed in healthy plants of the common woodland strawberry, *Fragaria vesca*, colonized either by the adult or immature stages of apterous viviparous females previously fed on plants of the same species showing symptoms of like intensity. Severe and mild manifestations of crinkle, respectively, were induced in healthy Royal Sovereigns by colonization with alate viviparous females after feeding on plants of the same variety showing crinkle symptoms of corresponding intensity. This result confirms the conclusion of Harris and King that the mild and severe forms of crinkle are etiologically distinct. The wingless forms of the vector are doubtless responsible for the spread of the virus within any given strawberry bed or field, while the winged forms carry the virus to other fields in the neighbourhood during the spring migrating period. Complete control of the vector is stated to be obtainable by fumigating the plants in the field with nicotine vapour.

Wormald (H.) & Montgomery (H. B. S.). **Strawberry leaf blotch.**—*Rep. E. Malling Res. Sta., 1941*, p. 44, 1942.

During 1941, the disease recently described by the authors as strawberry leaf blotch [*R.A.M.*, xxi, p. 86] and associated with a fungus resembling *Phyllosticta grandimaculans* Bubák, 1912, was found in seven different localities in Kent, mostly on Royal Sovereign plants, but occasionally on Huxley's Giant. The fungus may be the same as that described by Laibach in 1908 under the name of *Zythia fragariae*.

Tims (E. C.) & Bonner (Frances). **Method of obtaining pure cultures of Corticium stevensii from sclerotia.**—*Phytopathology*, xxxii, 9, pp. 824–825, 1942.

At the Louisiana State University, pure cultures of *Corticium stevensii*, the agent of fig and tung [*Aleurites*] thread blight [*R.A.M.*, xxi, pp. 206, 296], were obtained by the immersion of sclerotia (not more than one year old) from twigs of these hosts (predominantly the former) in a mixture of 1 in 1,000 mercuric chloride in 50 per cent. alcohol for two minutes, followed by washing in sterile water and plating on water agar. In some cases a supplementary dip in calcium hypochlorite was given, and two lots were flamed after immersion in alcohol. The percentages of sclerotia (1,500 in all) giving rise to *C. stevensii* ranged from 35 to 94, but the numbers free from contamination were much lower.

Croucher (H. H.). **The menace of leaf spot.**—*J. Jamaica agric. Soc.*, xlvi, 1–2, pp. 20–21, 1942.

After briefly reviewing the history of the spread of banana leaf spot [*Cercospora musae*] in the Caribbean, the author states that under Jamaica conditions [*R.A.M.*, xxi, p. 148] regular, efficient spraying against the pathogen must become a routine operation if good-quality fruit is to be produced. By the end of 1940 the Banana Leaf Spot Control Board had issued (free) nearly 3,000 units of spraying equipment. If fully used, these units could spray over 50,000 acres of bananas every three weeks. The records show, however, that only 25,000 to 30,000 acres are being sprayed with even approximate regularity. Many growers who started to spray failed to maintain the applications.

When banana shipments to the United Kingdom ceased, the Imperial Government offered to purchase a maximum of 12,000,000 stems of bananas at a rate of 3*s.* per bunch. Arrangements have since been made with American fruit companies for the sale of some of the bananas that cannot be shipped to England, but the standard required for the American market is higher than that formerly required for the European, and spraying becomes more urgently necessary than ever.

Nederlandsche namen voor plantenziekten bij landbouwgewassen. [Dutch names for plant diseases of agricultural crops.]—16 pp., Wageningen, Ned. PlZiekt. Vereen., Veenman & Zonen, 1941. [Abs. in *Z. PflKrankh.*, lii, 7–8, p. 398, 1942.]

This list of the Dutch common names of plant diseases prepared by the Dutch Phytopathological Society deals for the most part with deficiency disturbances, viruses, bacterioses, and mycoses of agricultural crops. Further lists for garden crops and forest trees are planned.

Proceedings of the Association of Applied Biologists.—*Ann. appl. Biol.*, xxix, 3, pp. 322–332, 1942.

At the meeting of the Association of Applied Biologists held in London on 17th April, 1942, W. M. Ware discussed hop downy mildew (*Pseudoperonospora humuli*) and its control [*R.A.M.*, xix, p. 691, xxi, p. 245]. A correlation between wet weather and serious attacks of the disease was established in Kent in 1927, 1930, 1931, and 1941. Only in these years was the rainfall in both July and August above the average for south-eastern England. Less damage was caused in 1941 than in the other years referred to, probably because of a more thorough application of control measures.

W. G. Keyworth briefly reviewed the present state of knowledge of hop *Verticillium* wilt (*V. albo-atrum*) [ibid., xix, p. 364], nettlehead [ibid., xix, p. 691], and mosaic [ibid., xvi, p. 836], and summarized the chief problems concerning these diseases that remain to be solved.

A. M. Massee reported, *inter alia*, various unsuccessful attempts to transmit hops mosaic and nettlehead by various insects, including both the hop flea-beetle

(*Psylliodes attenuata*) and the green leafhopper (*Empoasca flavescens*), considered to be vectors of both diseases by Continental workers.

H. MARTIN, dealing with the significance of the bio-assay in studies of fungicidal action, stated that two groups of factors affecting protective fungicides for foliage use are amenable to laboratory tests, viz., a quantitative group governing the amount and distribution of the protectant, and a qualitative group affecting toxicity, to which the term 'fungicidal value' is applied. The first group (including retention, coverage or penetration, and tenacity) is susceptible to physical and analytical examination; the second is more difficult, but at least two sets of factors may be distinguished, since the active fungicide is not always the actual chemical of the protectant. The evaluation of the toxicity of the active fungicide rendered available must involve methods of bio-assay. A standing committee of the American Phytopathological Society has undertaken to standardize the tests. These methods have as their object the exposure of organisms of standard biological history to known concentrations of the toxicant for a known period under standard environmental conditions. As a rule the result of each test is the number of organisms affected out of the total exposed, i.e., it is a quantal response for which statistical methods are available to correlate the results of different tests and to determine the significance of the pooled results.

The statistical treatment of the results of the bio-assay depends on the observation that a linear relationship may be deduced between a function of the concentration of the fungicide and its fungicidal effect, if the latter is expressed as normal equivalent derivations, to which C. I. Bliss added five and the term 'probit'. Parker-Rhodes has co-ordinated these observations by his 'theory of variability' [ibid., xxi, p. 422], and has established a theoretical basis for acceptance of the regression coefficient as a measure of the inherent toxicity of the protectant. The high potential value of the bio-assay is evident, but a simple correlation between toxicity as determined by its means and toxicity as determined by field performance can hardly be expected at present. General rules may, however, emerge which will in due course permit a reliable forecast of field performance by the summation of the results of laboratory tests, among which the bio-assay is of the first importance.

A. F. PARKER-RHODES gave an account of his new method of investigating the mechanism of fungicidal action [loc. cit.].

FINN (R. F.). **Mycorrhizal inoculation of soil of low fertility.**—*Black Rock For. Pap.* (*N.Y.*), i, 19, pp. 116–117, 1 fig., 1942.

In experiments at Warrensburg, New York State, during 1940 and 1941, the growth of white pine seedlings in boxes containing infertile clay-sand soil inoculated with known mycorrhiza-forming fungi [unspecified] was found to be significantly greater than that of uninoculated controls [cf. *R.A.M.*, xviii, p. 267]. The seedlings in the inoculated boxes, which developed mycorrhiza on 87 per cent. of the short roots, weighed 223·4 mg. per plant as compared with 155·4 mg. for those in the controls, which developed mycorrhiza on only 10 per cent. of the short roots; the seedlings in the inoculated series absorbed 2·05 mg. nitrogen and 1·52 mg. potassium per seedling as compared with 1·17 and 0·98 mg., respectively, for the controls. A characteristic yellow-green colour observed in the needles of the uninoculated seedlings is attributed to nitrogen deficiency.

REED (H. S.) & DUFRÉNOY (J.). **Catechol aggregates in the vacuoles of cells of zinc deficient plants.**—*Amer. J. Bot.*, xxix, 7, pp. 544–551, 8 figs., 1942.

This paper gives a description of the coacervated catechol aggregates [*R.A.M.*, xxi, p. 536] observed in the vacuoles of hypoplastic cells of leaves and the post-meristematic cells of growing shoots of apricot trees affected by little leaf due to zinc deficiency and in the cells of the leaves of walnut trees showing the same disease.

That a pathological condition was present in the walnut leaves was also indicated by the escape of necrotic material from the cells and its accumulation in the intercellular spaces; gum was also present in the intercellular spaces adjoining badly affected cells.

Sanford (G. B.). **Apical leaf speck of Potatoes.**—*Sci. Agric.*, xxii, 12, pp. 772–774, 1 fig., 1942.

Since 1938, potato plants growing near Edmonton, Alberta, in areas which, before being cultivated, were shallow depressions holding surface water in wet seasons, have shown a condition referred to as 'apical leaf speck'. In mild attacks the colour of the foliage and the yield of tubers may remain almost unaffected, but in more severe cases the vines are not very sturdy, the leaves and stems are chlorotic, and the length of the internodes is slightly increased. The tubers are generally small, but of normal shape. The early appearance of numerous very small, irregular, black dots or specks between the veins on the epidermis of apical leaves and, subsequently, the development of reddish-brown, necrotic areas of different shapes and sizes in the pith region of the top half of the stem are moderately constant diagnostic features. The necrotic areas usually appear at the nodes, but they may occur elsewhere; they develop first towards the top of the stem, are mostly absent in the lower half, and do not seem to form in the stolons or in the underground part of the main stem. Frequently the stem spots are visible by transmitted sunlight. All plants in an affected area develop the typical symptoms.

The disorder is not perpetuated by tubers from affected plants. When potato plants were grown in the greenhouse in soil from an affected area, the water content of which was subnormal, typical symptoms developed, but when the same soil was well watered, the pith and apical leaves remained normal, and no necrosis was observed in the tubers during storage. In two contrasting soil types, one high in organic matter but low in phosphorus and the other somewhat deficient in organic matter, potassium, nitrogen, and calcium, the plants grew well up to blossoming, when the reserve soil water apparently became deficient, and the condition appeared. The disorder is apparently caused by certain soil factors that favour faulty nutrition of the plant.

Balashev (N. N.). Вирусные болезни и явления вырождения Картофеля в Узбекистане. [Virus diseases and Potato degeneration in Uzbekistan.]—*C. R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 8, pp. 22–27, 3 figs., 1941.

Potato cultivation in Uzbekistan is stated to suffer severely from the gradual degeneration of imported varieties [cf. *R.A.M.*, xix, p. 359]. Thus, the yields of varieties Epicure, Lorch, and Wohltmann fell from 140, 192, and 181 zentner per ha. [zentner = 50 kg.] in the first year after importation to 68, 146, and 88, respectively, in the fourth year. The decline in productivity is coupled with a lower market value resulting from tubers of smaller average weight and deformed shape. In discussing the possible causes of this degeneration the author states that most of the well-known virus diseases occurring in Uzbekistan, such as mosaic, leaf roll, aucuba, and others, do not increase progressively from year to year and do not significantly spoil the appearance of tubers. On the other hand, two diseases, possibly due to one and the same cause as yet not clearly understood, were found to increase in violence from year to year.

The first of these two diseases, originally described by the author from Uzbekistan in 1938 (in '*Socialist Agriculture of Uzbekistan*', *1938*, 2, 1938) under the name of 'leaf-twisting' is stated to resemble spindle tuber and a disease described under the name of 'gothic' from the U.S.S.R. by Tereshchenko. It noticeably depresses the growth and the flowering capacity of the plant, causes the development of fewer

stems and of more lateral branches, and makes the leaves grow upwards. At the end of the season the tips of the stems and lateral branches may bend, becoming knotty and unelastic; and the blades of the leaves either curl up or fold up along the midrib, the margins becoming slightly wavy. The disease differs from leaf roll in that the upper, youngest leaves and not the oldest ones begin to roll up first, and that they do not become brittle; it resembles yellow dwarf in most symptoms, except that it does not produce chlorosis and extreme dwarfing. The diseased plants sometimes develop abnormally small leaves, which may exhibit symptoms of mosaic or severe necrosis. The symptoms of 'leaf-twisting' generally vary with the variety of potato and are not always all present at the same time. Tubers from diseased plants are elongated and often spindle-shaped or constricted in the middle, with numerous, very protruding eyes. In varieties with red or pink tubers the colour is paler in diseased plants. The percentage of cracked tubers in five varieties tested ranged from 1·4 to 28·2 in healthy as against 8·8 to 100 in diseased plants. The annual increase in the intensity of the disease was considerable in all nine varieties tested; in the variety Wohltmann the percentage of diseased plants rose from nil in the first year after importation to 88·3 in the fourth.

The second disease held responsible for degeneration in Uzbekistan and designated 'little leaf' is characterized by abnormally small and light green leaves with slightly wavy margins. In severely diseased plants leaves and sometimes stems dry off, beginning from the top of the plant downwards, and the plants are somewhat stunted. The yields of diseased plants are considerably lower than those of healthy ones, amounting, for the variety Epicure, to 23·7 and 28·9 per cent. of the healthy yield in early and late sowings, respectively. Furthermore, the disease causes a decrease in the number of tubers per plant and in the percentage of harvested tubers of marketable size. The percentage of Epicure potato plants affected by the disease was found to increase from 1·8 in the first year of importation to 74·7 in the fourth. It is concluded that 'leaf-twisting' and 'little leaf' are the two main expressions of potato degeneration in Uzbekistan and must as such be taken into account in potato certification.

Hansen (H. P.). **Studier over Kartoffelviroser i Danmark II. Fortsatte Sortsundersøgelser.** [Studies on Potato viruses in Denmark II. Further varietal studies.]—*Tidsskr. Planteavl*, xlvi, 2, pp. 355–362, 1942. [English summary.]

Continuing his studies on potato viruses in Denmark [*R.A.M.*, xvii, p. 338], the writer examined apparently healthy plants of 15 varieties (11 immune from wart disease [*Synchytrium endobioticum*]) for the presence of spontaneous infection. Virus-free clones of Ackersegen, Direktor Johanssen, Di Vernon, Flava, Parnassia, Voran, Bintje, Sydens Dronning [Queen of the South], and probably Tylstrup Odin were obtained. Some of the clones of Parnassia, Voran, and Tylstrup Odin, and all those of Kerr's Pink and Majestic, contained virus X, which was also present, together with B [ibid., xix, p. 723], in every one of Kaiserkrone and Snowdrop, while Juli consistently harboured virus A. All the varieties reacted to virus Y with leaf drop streak or rugose mosaic, the symptoms in Di Vernon being very mild and indistinct. All the varieties under observation acted as symptomless carriers of virus X except King Edward (top necrosis) [ibid., xv, p. 310] and Juli (simple mosaic or crinkle associated with infection by virus A). Top necrosis developed in Ackersegen, Juli, Kerr's Pink, Bintje, King Edward, and Tylstrup Odin inoculated with virus B, the other varieties being symptomless, and the same symptoms appeared in Kerr's Pink and Sydens Dronning artificially infected with A, which induced crinkle or severe simple mosaic in Majestic, Parnassia, Snowdrop, and Tylstrup Odin (all generally containing X or X+B), the remainder being symptomless carriers of A (except for the immune Di Vernon).

Bonde (R.), Stevenson (F. J.), Clark (C. F.), & Akeley (R. V.). **Resistance of certain Potato varieties and seedling progenies to ring rot.**—*Phytopathology*, xxxii, 9, pp. 813–819, 1942.

Out of 54 named American and foreign potato varieties and 65 unnamed seedling varieties tested in Maine for their reaction to ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*], a major disease in 37 States [*R.A.M.*, xxi, p. 502], only two of the former were resistant, namely, the Dutch Friso and the British President, and two of the latter, arising from the progeny of crosses between S. 41956 and Earlaine, and Earlaine and 43055. In addition, nearly half the seedling varieties from the resistant President × susceptible Katahdin cross escaped infection, while a few selections from a cross between the two susceptible varieties 336–123 and 47156 were more resistant than either parent. From these limited experimental data the development of varieties resistant to ring rot would appear to be quite practicable.

Ryker (T. C.) & Chilton (S. J. P.). **Inheritance and linkage of factors for resistance to two physiologic races of Cercospora oryzae in Rice.**—*J. Amer. Soc. Agron.*, xxxiv, 9, pp. 836–840, 1 fig., 1942.

The resistance of the Blue Rose 41 rice selection to *Cercospora oryzae* race 1 [*R.A.M.*, xx, p. 490] was found at the Baton Rouge and Crowley (Louisiana) Experiment Stations to be governed by a single dominant factor, while the moderate resistance of the parent variety to race 2 of the pathogen is attributable to another single dominant factor. The parent Blue Rose variety occupies about 49 per cent. of the total rice acreage in the southern States and is highly susceptible to race 1. A close linkage was shown normally to exist between resistance to one race of *C. oryzae* and susceptibility to the other, but the progeny of crosses between Blue Rose and selection 41 comprised a very few individuals of homozygous resistance to both, giving hope of further developments in breeding along the same lines.

Teakle (L. J. H.). **Copper deficient soils in Western Australia.**—*J. Aust. Inst. agric. Sci.*, viii, 2, pp. 70–72, 1942.

In Western Australia the main soil groups deficient in copper [*R.A.M.*, xxi, p. 92] are (1) the cretaceous areas at Gingin and Dandaragan, (2) the south-west coastal districts, (3) the coastal sand hills, and (4) the sandy and gravelly soils of the wheat belt. The copper content of certain plants, e.g., subterranean clover (*Trifolium subterraneum*), wheat [see above, p. 17], or oats, indicates the copper status of the soils in which they are grown.

Under Western Australian conditions maximum responses are generally obtained from applications of 5 to 10 lb. copper sulphate per acre, or its equivalent. On very sandy and gravelly soils, maximum responses have been obtained from $2\frac{1}{2}$ lb. copper sulphate per acre. On these soil types yields have sometimes been considerably reduced where even 5 lb. copper sulphate per acre have been applied. Although the copper sulphate is mixed with superphosphate, very small amounts may be toxic in soils low in organic or inorganic colloids. Where rainfall is higher, and on soils containing appreciable quantities of clay or humus, over 10 lb. copper sulphate per acre may be used without harmful effect, but also without benefit to yields. The residual value of small applications of copper is considerable, the succeeding crop sometimes making little or no response to further treatment.

Muhr (G. R.). **Plant symptoms of boron deficiency and the effects of borax on the yield and chemical composition of several crops.**—*Soil Sci.*, liv, 1, pp. 55–65, 5 figs., 1942.

At the Michigan Agricultural Experiment Station the writer carried out a series of tests to determine the characteristic symptoms of boron starvation and to secure

plant material for chemical analysis. Sugar and canning beets, maize, turnips, dandelions [*Taraxacum officinale*], barley, and winter wheat were grown in 1-gal. earthenware jars containing Thomas sandy loam, rutabagas [swedes] on Brookston clay loam, and mangels, radishes, and chicory in quartz sand cultures, boron being withheld from some and incorporated with the nutrient medium at varying rates in others. Supplementary field trials were conducted with both kinds of beet and with swedes.

Detailed descriptions of the symptoms induced by boron deficiency are given. In sugar beet an inverse relationship was found to exist between boron and iron and boron and nitrogen in the beet plant, and similar relationships were observed in swedes. In maize the boron-iron relations were again similar, but the nitrogen content was not affected by the variations in that of boron.

Hoerner (G. R.). **A study of spreaders for use on Hops in the field control of downy mildew.**—*Phytopathology*, xxxii, 9, pp. 820–823, 2 figs., 1942.

The use of spreaders is essential for the proper dispersal of the liquid sprays applied to hop leaves for the control of downy mildew (*Pseudoperonospora humuli*), and the writer therefore tested a number of preparations at the Oregon State College for their efficacy in this respect. In the laboratory satisfactory coverage of the under sides of excised leaves was secured by means of a small air-compressor, equipped with an oil and air filter, operated by a $\frac{1}{4}$ hp. electric motor. The more promising spreaders were subsequently given further trials in the greenhouse and field.

The most effective of the 36 adhesives tested were the rosin soaps [*R.A.M.*, xix, p. 616], at least six different formulas of which were compared, that finally selected for field use consisting of a stock solution prepared from 25 lb. rosin, 6 lb. caustic potash, and 25 gals. water. A minimum of 1 pint of stock solution should be incorporated with 100 gals. of any fungicide used in field operations.

Keyworth (W. G.). **Notes on Hop diseases in 1941.**—*Rep. E. Malling Res. Sta., 1941*, pp. 42–43, 1942.

In these notes on hop diseases in south-eastern England in 1941 it is stated that *Verticillium* wilt [*V. albo-atrum* and *V. dahliae*: see above, p. 33] was reported nine times. The disease remains a serious menace on many farms, and the control of large outbreaks is likely to prove very difficult and expensive. Evidence was obtained that the disease can be introduced into commercial gardens by the planting of infected sets.

Nettlehead [ibid., xix, p. 691] was found to be transmissible by grafting, and is, therefore, probably due to a virus. In very warm weather the symptoms are masked. Diseased hills should be removed whenever the symptoms are seen, starting very early in the season.

Fluffy tip [ibid., xix, p. 364] was widespread between 26th and 30th June, reports of its presence being received from places as far apart as Benenden, Maidstone, Penshurst, East Kent, and even the West Midlands. Both the Fuggle and Golding varieties were attacked, but the disease was less prevalent on the latter. In some gardens 50 per cent. of the bines were affected. On most farms the trouble did not persist, the bines growing away and leaving a 'short-jointed' portion where the check had occurred. Where the check to the bines was permanent they failed to make further growth, fell away from the string, and finally died back for several feet; on such bines, the laterals became reduced in size, and showed distorted leaves bearing ring-shaped, yellow markings and dead patches.

The first outbreak of chlorotic disease [ibid., ix, p. 742; xv, p. 257] to be recorded in south-eastern England occurred in 1941 in a Fuggle garden at East Peckham; previously the disease had been observed only in Worcestershire.

In one Fuggle garden split leaf blotch [ibid., xix, p. 364] caused heavy reduction

of crop. Mosaic was again prevalent in the Golding yards in the West Midland area. *Armillaria* disease [*A. mellea*: loc. cit.] was still present on hops planted three years before on the site of an old orchard, but repeated grubbing and replanting appeared to reduce the severity of the attack.

REINMUTH (E.). **Die parasitäre Blattdürre, eine für den Mohnbau bemerkenswerte Krankheit.** [Parasitic leaf desiccation, a noteworthy disease in Poppy cultivation.]—*Angew. Bot.*, xxiv, 3–4, pp. 273–277, 2 figs., 1942.

Although severe damage to the opium poppy [*Papaver somniferum*] from *Pleospora calvescens* (*Helminthosporium papaveris*) [*R.A.M.*, xvii, p. 96] has been reported of recent years from south-eastern Europe, notably Bulgaria, the foliar desiccation and browning for which the fungus is responsible has hitherto attracted little attention in Germany. In 1941, however, an outbreak of the disease occurred in Mecklenburg, chiefly on light soils, the symptoms first becoming noticeable during a dry spell in the latter part of June and steadily increasing in virulence. Infection originated at the stem base and was sometimes accompanied by damping-off of the underground system; black, necrotic lesions developed on the cortex at the points of insertion of the shrivelled leaves, which were occasionally replaced by adventitious leaflets. A few inflorescences attacked by *Trichothecium roseum* and *Aspergillus* as well as *P. calvescens* turned black and fell prematurely, but in general the heads were not extensively involved. Sections through the stems of old diseased plants revealed the presence of necrotic areas in the tissues near the vascular bundle ring. Typical conidia of the *Cylindro-Helminthosporium* subgroup were observed in profusion on the infected surfaces. *Cladosporium herbarum* was detected in the centre of the stigma in a few of the shrivelled capsules. *P. calvescens* probably demands warm conditions for its optimum development, and control measures (which should include seed disinfection with a mercurial dust and treatment of the growing plants with a copper containing fungicide) are briefly discussed in the light of these requirements.

EKSTRAND (H.). **En sjukdom på Vallmo.** [A Poppy disease.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, v, 4, pp. 50–53, 4 figs., 1941.

During the summer of 1941 the fungus *Pleospora calvescens*, hitherto unknown in Sweden, was observed to be causing a disease of opium poppies (*Papaver somniferum*) in a fair-sized planting in West Gothland. The symptoms consisted of foliar discoloration, black spots on the stems and petioles, and wilting of the flower buds [see preceding abstract], late floral infections resulting in partial or total shrinkage of the capsules and disorganization of the seed embryos. There is reason to believe that the pathogen is seed-borne.

ABBOTT (E. V.). **Results of experience with chlorotic streak in Louisiana in 1941.**—*Sug. Bull., N.O.*, xx, 18, pp. 161–165, 1942. [Abs. in *Sugar*, xxxvii, 10, p. 44, 1942.]

In 1941 chlorotic streak reduced the acre yield of sugar from C[anal] P[oint] 28/19 by 26·6 per cent. and that from C.P. 29/320 by 56·6 per cent., thereby confirming the previous estimate of the potential importance of this disease on several commercial sugar-cane varieties grown in Louisiana. In both varieties the first stubble suffers much more severely than the plant cane. In addition to a rigorous programme of roguing and provision for ample supplies of healthy seed, hot-water disinfection of the seed pieces may be practised. C.P. 33/243 appears to be less susceptible to chlorotic streak than some other members of the same group, and it is unlikely that Co. 281 and 290 will sustain appreciable injury from the disease, which is carried by the common leafhopper *Draeculacephala portola* [*R.A.M.*, xxi, p. 266].

KARLING (J. S.). **The Plasmodiophorales.**—ix+144 pp., 17 pl., New York City, published by the author, 1942. $3.75.

Since the publication of W. R. I. Cook's monograph of the Plasmodiophorales in 1933 [*R.A.M.*, xiii, p. 60] several new genera and species have been incorporated in the group, the concepts of which have further been modified by some important new discoveries, making the present revision opportune, and in fact essential. Although the treatise is intended primarily for students of mycology, phytopathologists and other scientists are likely to be interested in the work, special features of which include diagrams of the life-cycles of various species and descriptions of two major diseases caused by members of the family, namely, club root of crucifers (*Plasmodiophora brassicae*) [a particularly full and valuable account of which is given] and powdery scab of potatoes (*Spongospora subterranea*), with supplementary data in each case on the geographical distribution of the pathogens and bibliographical references to the relevant literature. Among the other genera discussed are *Sorosphaera*, *Sorodiscus*, and *Ligniera* (with which *Rhizomyxa*, *Sorolpidium*, and *Anisomyxa* are probably synonymous), *Trematophlyctis* and *Pyrrhosorus* being regarded as of doubtful authenticity, while *Sporomyxa*, *Peltomyces*, and *Cystospora* are excluded from the family.

OVERHOLTS (L. O.). **The Polyporaceae of Pennsylvania III. The genus Poria.**—*Bull. Pa agric. Exp. Sta.* 418, 64 pp., 1942.

In the third paper of this series [*R.A.M.*, xiv, p. 795] the author gives a list of 69 species (including eight new ones) of *Poria* occurring in Pennsylvania. A key is provided and detailed descriptions given for all species. *P. callosa* is described as the cause of an important decay of coniferous structural timber, producing a brown rot in no wise different from that of *Trametes serialis*. *P. cinerescens* is stated to be of considerable importance as an agent of decay of conifer slash. *P. unita* (Pers.) Cooke, long known to mycologists as *P. medulla-panis* [ibid., xvi, p. 3] (a species that cannot now be identified), is common on hardwood structural timbers throughout the United States and Canada. Other species prevalent on structural timber are *P. vaillantii*, common in damp situations throughout the United States, and *P. incrassata*, one of the most destructive decay fungi, more or less confined to regions of high humidity, such as the southern States and the Pacific coast. The author confirms Campbell and Davidson's identification of the fungus causing the sterile conchs on birch as *P. obliqua* [ibid., xviii, p. 146].

DÉFAGO (G.). **Seconde contribution à la connaissance des Valsées von Höhnel.** [Second contribution to the knowledge of the Valseae von Höhnel.]—*Phytopath. Z.*, xiv, 2, pp. 103–147, 8 figs., 1942.

Continuing his studies in Switzerland on the Valsaceae [*R.A.M.*, xv, p. 447], the writer describes the morphological, physiological, and cultural characters of certain species to which special attention was paid, and discusses their taxonomy. The name *Valsa ceratophora* Tul. is maintained against *V. ceratosperma* (Tode) Maire [ibid., xvi, p. 562] on the ground that the application of the name *S. ceratosperma* Tode can now only be guessed at. The fungus is widespread throughout Europe, and has been observed by the writer on 24 trees and shrubs in the Lower Valais, the following hosts probably constituting new records: alder (*Alnus viridis*), quince, *Cytisus nigricans*, *Frangula alnus*, walnut (*Juglans regia*), juniper, damson, and yew. Though ordinarily a saprophyte on dead branches, the hyphae of the fungus have occasionally been observed to pass from a dead patch on the bark to the living tissues. The minimum, optimum, and maximum temperatures for the growth of a strain of *V. ceratophora* from privet on potato agar were 0°, 23°, and 34° C., respectively.

The structure and appearance of the fructifications of corticolous fungi are largely determined by their hosts: in the case of *V. ceratophora* and other species of *Valsa*,

Diaporthe, and *Melanconis* the features thus influenced include (1) the shape of the stroma and disk, which is rounded on young twigs, e.g., of rose, lime (*Tilia*), *Cornus*, *Salix*, but oval on branches or stems with a thicker rhytidome (birch, *Prunus*, walnut); (2) the site of the stroma and the mode of rupture of the periderm, i.e., transverse on *Prunus* and birch, longitudinal on the vine and other plants of which the bark ruptures lengthwise, and circular on one-year-old rose twigs; (3) the thickness of the stroma, which measures 1 mm. on twigs and 2 to 3 mm. in a thick cortex; the more resistant the rhytidome to penetration, the better developed is the stroma; (4) the colour of the disk, depending largely on the entostroma, which contains the remnants of the host; it is generally brownish, but may appear whitish, as on privet and beech; and (5) the number of perithecia, which corresponds with the volume of the stroma and ranges from three or four per fructification on a twig to 60 or 80 on a thick cortex. The length of the ostioles is increased by abundant humidity and probably by light, but ordinarily the perithecial beaks do not extend beyond the disk; Nitschke's erection of the subdivision *Euvalsa* for ten species with elongated ostioles (Pyrenomycetes germanici, 1867) is attributed to a misconception, the supposed specific character being merely an effect of environmental factors. The length of the axis of *V. ceratophora* was found to range from 26 (walnut) to 45 μ (*T. cordata*), with a mean from 32 to 35 μ, and the width from 3·5 to 7·5 (5) μ, the dimensions of the ascospores being 8 to 9 by 1·5 to 1·9 μ. The pycnospores of *Cytospora ceratophora* form glutinous, yellowish-white cirrhi (amber-yellow when dry), are borne on conidiophores, 8 to 12 by 1·5 to 2 μ, and measure 3 to 9 by 0·9 to 2·5 ($4{\cdot}8\pm0{\cdot}64$ by $1{\cdot}47\pm0{\cdot}11$) μ. Nineteen specific names are relegated to synonymy with *V. ceratophora*.

V. cypri Tul. was found frequently after fire damage; its pycnidia, which have frequently in the past been identified with *C. pruinosa*, are here distinguished from it and renamed '*C. cypri* (Tul.) Défago'.

In 1823 Fries described *Sphaeria pruinosa* on ash, and since that time a very common *Cytospora* on ash has been variously known as *C.*, *Dendrophoma*, or *Cytophoma pruinosa*. After seven years' search the author has discovered its perithecia, the first time, so he claims, that they have been seen since Fries described them as *S. pruinosa* Fr.; he accordingly proposes the name *V. pruinosa* (Fr.) Défago. The genetic connexion between the two stages was established by pure cultures from asco- and pycnospores, both of which gave rise to yellow-brown colonies with few aerial hyphae and numerous pycnidia. The unilocular pycnidia of the asexual stage, designated '*C. pruinosa* nob. nec Sacc.' resemble those of *V. cypri* in internal structure, but are higher and narrower, besides being much more numerous both on the host, the periderm of which is sometimes extensively ruptured, and in pure culture. *C. pruinosa* has also been found on lilac, on which it must be distinguished from *V.* (*C.*) *syringae* Sacc., the latter being characterized by pluriloculate pycnidia and a well-developed, greyish ectostroma. *V. pruinosa* differs from *V. cypri* principally in its larger and more numerous pycnidia, perithecia, and asci, its smaller and broader ascospores, its higher temperature requirements, and its darker brown mycelium. Other species of *Valsa* occurring on ash include *V. syringae*, *V. mediterranea*, *V. leucopsis*, *V. grisea*, *V. fraxinina*, and *V. orni*, the taxonomy of which is briefly discussed: the last-named may be identical with *V. cypri*.

A fungus collected during five successive winters in larch forests agreed in the main with Nitschke's description of *V. curreyi*, but the presence at the base of the perithecial and pycnidial stromata of a black zone led the author to transfer it to the genus *Leucostoma* as *L. curreyi* (Nit.) nov. comb., the imperfect stage being designated *Leucocytospora curreyi* (Sacc.) nov. comb. (syn. *C. curreyi* Sacc.).

Leucostoma [*V.*] *cincta* has been found on two new hosts, *Cornus sanguinea* and quince, the latter having probably been contaminated by spores from adjacent peach branches. The fungus is very prevalent throughout Switzerland on hedges of *P. laurocerasus*, and cross-inoculations with strains from *C. sanguinea*, quince, and

P. laurocerasus were successful on *C. sanguinea*. Von Höhnel was probably right in his opinion that *V. macrostoma* Rehm nec Fuck. and *V. rehmii* Wint. are its synonyms.

Following the author *C. cincta* should be known as *Leucocytospora cincta* (Sacc.) von Höhn. *C. ambiens*, the pycnidial stage of *V. ambiens*, another common occupant of *Prunus* [ibid., xx, p. 6], differs from the foregoing in the absence of a basal zone and in having wax-coloured cirrhi. *L. persoonii* [*C. leucostoma*] is more nearly related to *L. cincta* than any of the other species on *Prunus*, but the pycnidia of the former are blackish and those of the latter brown, while the cirrhi of the two species are dark red and pale pink, respectively, and the pycnospore dimensions 5 to 5·5 by 1 to 1·2 μ and over 6 by 1·3 μ, respectively. *C. sydowii* Gutner (1934) is relegated to synonymy with *C. cincta*.

Since 1934 *V. leucostoma* has been observed on *Sorbus* [*Pyrus*] *aria*, *S.* [*P.*] *aucuparia*, *Cornus sanguinea*, and *Prunus lusitanica*. In his previous study the writer found that it comprises several physiologic races, and the question arose whether their thermal relationships are influenced by climatic conditions. The fact that a race of the fungus from *Pyrus aucuparia* collected at an altitude of 1,500 m. above sea-level required almost as high temperatures as those from central Valais or Japan (21° to 27° and 30°, respectively) for satisfactory growth would appear to exclude the environment as an important factor in this connexion.

FORBES (A. P. S.). **Some observations on the 'yellows' sulphur deficiency disease of Tea.**—*Nyasald agric. quart. J.*, ii, 3, pp. 20–26, 1942.

The 'yellows' disease of tea found in Nyasaland, where it is caused by sulphur deficiency [*R.A.M.*, xii, p. 537], shows four distinct stages, the symptoms of which are described.

Before 1932 a great deal of the tea in Nyasaland was planted in old rubber, coffee, or tobacco land naturally deficient in sulphur, and to which fertilizers were seldom applied. Since then most of the tea has been planted on virgin soil, but the disease still persists. Careless planting is also a predisposing factor, as it militates against the quick establishment of a healthy stand. High 'jat' bushes are more susceptible than low ones throughout their life. Excessive rainfall in any one season conduces to the development of the disease in high 'jat' tea in March or April but an application of sulphur-containing fertilizer in late February corrects the condition. Lack of moisture also conduces to 'yellows' attack in three to four weeks, while tea on 'bunds' and hard pans begins to show signs of the disease after quite a short period of drought. 'Yellows' symptoms appear much more quickly in young tea than old. Estates which cultivate deeply at least once a year seem to withstand conditions conducive to yellows much better than estates continually shallow-cultivated.

Any type of organic or inorganic fertilizer which contains sulphur in an available form or a form which becomes available will cure 'yellows' provided it has not reached the most advanced stage. Cattle manure and urine earth are particularly valuable in this respect. Urine earth is formed by putting 3 to 6 in. of soil on the floor of the cattle shed and placing the general bedding on top; if this earth is dug out every two or three months it forms a rich fertilizer of great value against 'yellows'. Fertilizers containing sulphur which becomes available only after a time-lag are useless in any area in which the disease is rapidly spreading. Time of application is important with young tea, which should receive two small applications rather than one large one. If a suitable fertilizer is applied every year, the disease is less likely to appear than if it is applied at irregular intervals. When available sulphur is insufficient, only light pruning should be practised.

Suitable fertilizers are ammonium sulphate, potassium sulphate, sulphur, cattle manure or cattle compost, and ordinary superphosphates. Observations showed that tea bushes cannot maintain a reserve of sulphur internally; available sulphur must always remain in contact with the roots. Providing that not too many conducive

factors are present, tea well-fertilized in the past can, apparently, be safely left unfertilized for two years, before any noticeable incidence of 'yellows' begins.

GADD (C. H.). **Report of the Mycologist for 1941.**—*Bull. Tea Res. Inst. Ceylon* 23, pp. 26–42, [? 1942].

In a report contributed by T. E. T. Bond it is stated that phloem necrosis has now been identified on 117 tea estates in Ceylon [*R.A.M.*, xx, p. 599]. Specimens received from an estate in the Passara district showed a peculiar undulate habit of growth; the shoots proved, however, to be free from necrosis, and the cause of their condition was not apparent. This wavy habit was probably confused with the zigzag condition, which is commonly, but not invariably, associated with phloem necrosis. Severely diseased bushes with curled leaves and zigzag shoots were often observed to give rise to apparently healthy shoots. On microscopic examination, however, such shoots were found to be heavily necrotic and cuttings propagated from them usually exhibit marked symptoms of disease and are indistinguishable from those obtained from other parts of the bush. Continued field observations at St. Coombs showed that the percentage of necrotic bushes in all the plots had increased by 10 per cent. during the year and now stands at 21 per cent. Some of this increase is attributed to an improved method of examining doubtful bushes, involving the stripping-off of small portions of bark from the stems (or roots, where practicable). By these means necrosis can often be detected when its presence in the leaf stalk is uncertain. The disease is stated to be generally increasing in severity and the symptoms becoming more strongly pronounced. The rate of increase in the percentage of necrotic bushes on a large plot in the Kandapola district amounted to about 1 per cent. of a total of 985 bushes per month, and thus corresponded closely to that calculated for the preceding two years. Roguing experiments commenced in the same district during the previous season were continued with good results, indicating that this is a feasible, if costly, method of control.

Records from several estates showed a marked decline in yield of the most heavily necrotic fields during the last ten years. Rigorous removal of non-productive bushes from such fields was found to be economically worth while. No definite cases of phloem necrosis were observed among 6- to 15-year-old supplies on several estates, and only one or two authentic instances have so far been found in young plants in the field. These field observations, which are likely to receive further confirmation from the experimental side, strongly suggest a possible immunity in high jat supplies. In experimental work the need of a reliable method of disease transmission is stressed. The interpretation of experimental results was further hampered by the unexpectedly widespread occurrence of various kinds of necrosis very similar to phloem necrosis in its early stages. The examination of nearly 250 root grafts, of which but few survived, showed that 12 out of 18 low jat scions were necrotic, while all the 16 high jat scions were still quite healthy. Pending final results, which are expected in about a year's time, it appears highly probable that the high jat material is immune from, or at least tolerant of, the disease.

'False necrosis', in which necrosis is confined to the leaves and no external symptoms appear, has hitherto been found in mature plants in the field, but this year it was observed to be widespread in various types of seedlings, particularly in those raised in peat, i.e., under somewhat abnormal conditions. There is no reason to believe that the condition is identical with phloem necrosis. Examination of young cuttings raised since the middle of the preceding year from necrotic bushes showed typical symptoms on all but a few, while no such symptoms were found on cuttings from healthy bushes and very little 'false necrosis' occurred on them.

The latest records of the oldest, nearly four-year-old, necrotic cuttings on their own roots showed them to be small and obviously diseased. The capacity of the disease

to reproduce itself in transplanted bushes, in cuttings, and in grafted scions to an indefinite extent, taken in conjunction with the available evidence from field observations and from experimental work, are considered to argue strongly in favour of a virus origin of phloem necrosis, although the data from graft transmission experiments are still not entirely convincing. Two theories, one postulating a deficiency of boron and the other an excess of chromium as causative agents of phloem necrosis, received no support from two experiments designed to test them.

Frampton (V. L.). **A quantitative method for assay of Tobacco mosaic virus protein.**—*Phytopathology*, xxxii, 7, pp. 618–622, 2 graphs, 1942.

A quantitative method for the assay of tobacco mosaic virus protein by serological methods [cf. *R.A.M.*, xx, p. 316] is described.

Stanley (W. M.). **The preparation and use of Tobacco mosaic virus containing radioactive phosphorus.**—*J. gen. Physiol.*, xxv, 6, pp. 881–890, 2 pl., 1942.

Healthy and mosaic-diseased Turkish tobacco plants were grown in sand and supplied with a complete nutrient solution containing radioactive phosphorus. Determinations were made of the distribution of the radioactive phosphorus. Both chemical analyses and radiographs revealed the same amount of phosphorus in the normal and infected foliage, some 30 per cent. of the radioactive phosphorus absorbed by the latter being combined with the purified virus isolated from the diseased plants. Following the inoculation of purified tobacco mosaic virus of high radioactivity into normal plants, most of the radioactivity was found to be associated with non-virus components, of which about 40 per cent. were in the inoculated and the remainder in the uninoculated portions of the plants. A small but significant amount of radioactivity (5·8 per cent.) was detected in the virus isolated from the uninoculated upper leaves.

Knight (C. A.). **The physical and chemical properties of a distinctive strain of Tobacco mosaic virus.**—*J. biol. Chem.*, cxlv, 1, pp. 11–18, 1942.

The rib-grass (*Plantago lanceolata*) strain of the tobacco mosaic virus [*R.A.M.*, xxi, p. 227] was isolated from artificially infected Turkish tobacco plants and purified by differential centrifugation. The rib-grass strain resembled the ordinary virus in most of its physical and chemical properties, and serological tests showed the two viruses to have common antigenic groups, but each also possesses distinctive groups absent from the other.

Köhler (E.). **Ueber vergebliche Versuche, beim Tabaksmosaikvirus 'Mutationen' in Rohsäften zu erzielen.** [On unsuccessful attempts to induce 'mutations' of the Tobacco mosaic virus in crude juices.]—*Z. PflKrankh.*, lii, 7–8, pp. 392–395, 1942.

Negative results were given by all the writer's attempts to induce the development of yellow strains of the tobacco mosaic virus from green strains and vice versa through mutation by exposure of the infective crude juices to high temperatures (up to 85° C.). The 234 single infections produced by the treated juice samples on Samsun tobacco, *Nicotiana glutinosa*, and *Datura stramonium* were identical with those developing as a sequel to inoculation with the initial unheated virus.

Shapovalov (M.), Blood (H. L.), & Christiansen (R. M.). **Response of the Tomato plant to spacing.**—*Proc. Utah Acad. Sci.*, xviii, pp. 91–94, 1941.

Further data are given on the favourable response of curly-top tomatoes in the Hooper district of Utah to close spacing [*R.A.M.*, xxi, p. 103], the following yields being obtained during the five-year (1936 to 1940) series of experiments under discussion: 1936 (*a*) 42 in. apart, one plant per hill, 2·46 tons per acre; (*b*) same distance,

two plants (no figures given); (*c*) 21 in., one plant, 2·92 tons; (*d*) same distance, two plants (no figures); (*e*) $10\frac{1}{2}$ in., one plant, 5·46 tons; the corresponding figures for the five treatments in 1937 were 4·32, 6·40, 6·40, 8·66, and 7·23 tons per acre, respectively; in 1938 for (*a*), (*b*), (*c*), and (*d*), 9·80, 10·74, 11·90, and 13·77 tons, respectively; in 1939 for the same four 11·30, 13·61, 15·48, and 17·35 tons, respectively; and in 1940 for all treatments 4·77, 10·38, 9·44, 12·99, and 14·40 tons, respectively. Taking $9.75 per ton as the average price of canning tomatoes and $3.00 per thousand as that of plants, and estimating the total extra cost of labour and plants at $40.00 per acre, the increased yields in 1937 and 1938 sufficed to cover the additional expenses of operation, while in the two succeeding years a clear profit was secured.

Bewley (W. F.). **Director's Report.**—*Rep. exp. Res. Sta. Cheshunt, 1941*, pp. 14–32, 1942.

In a trial at Cheshunt in 1941 of tomato varieties resistant to leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xxi, p. 172], the Vetomold variety proved immune from attack and gave an average yield of 36·8 tons per acre. Neither of two Danish varieties Virum A and Virum B was immune, some plants showing high resistance, while others were as susceptible as ordinary commercial varieties. The Cheshunt variety Leaf Mould Resister No. 1 was highly resistant. Vetomold tomatoes also did well as an outdoor crop, one grower reporting some resistance by this variety to *Phytophthora infestans*. It appears to be well worth trial in any nursery where leaf mould is serious, especially as a late or second crop.

Swingle (R. U.). **Phloem necrosis: a virus disease of the American Elm.**—*Circ. U.S. Dep. Agric.* 640, 8 pp., 4 figs., 1942.

Phloem necrosis of the American elm (*Ulmus americana*) [*R.A.M.*, xix, p. 172], first observed at Ironton, Ohio, in 1918, but believed to have been present in several States for many years, is now known to be generally distributed in the southern halves of Ohio, Indiana, and Illinois, south-eastern Missouri, north-western Tennessee, Kentucky, and western West Virginia, up to 75 per cent. mortality from this source having been recorded in some localities during the past five years. The two specific, diagnostic symptoms of the disease are a yellow, yellowish-brown, or 'butterscotch' discoloration of the phloem of buttress roots or the lower trunk and a faint odour of wintergreen, the external features of foliar scarcity, chlorosis, desiccation, and defoliation being merely indicative. The means of spread of the causal virus under natural field conditions are unknown, but in Ohio, where the disease has been under close observation for several years, dissemination has been rapid, affected trees suddenly appearing at distances of 10 to 25 miles from any recognized focus. The infective agent is readily transmissible by grafting with bark patches or entire sections of roots and branches, specific symptoms developing within six months to two years in 75 per cent. of the trees grafted with diseased roots and in 90 per cent. of those into which affected branches or bark patches were inserted.

Gossard (A. C.) & Parson (H. E.). **Duration of the effect of zinc sulfate treatment on large, badly rosetted Pecan trees.**—*Proc. sth-east. Pecan Grs' Ass.*, xxxv, pp. 31, 33, 35–36, 1941. [Abs. in *Chem. Abstr.*, xxxvi, 15, p. 4660, 1942.]

Stuart pecan trees growing on Red Bay fine sandy loam developed rosette [*R.A.M.*, xix, p. 736] about two or three years after the application of oyster-shell meal at the rate of five tons per acre, the severity of the disease increasing annually to such an extent that in six or seven years after the treatment many of the trees were suffering seriously from die-back. A marked improvement was secured by soil applications of 5 or 20 lb. zinc sulphate per tree, a second treatment being given in the following year; the full corrective effect of the compound persisted for four to five years. More rapid, though less striking results were given by injections of 50 gm. zinc sulphate, the protection conferred by which, however, lasted for only about two years.

Bingham (T. R.). **Secondary fungi associated with White Pine blister rust cankers.**—Abs. in *Northw. Sci., Wash.*, xvi, 2, p. 39, 1942.

Among the secondary fungi observed in association with western white pine [*Pinus monticola*] blister rust [*Cronartium ribicola*] cankers in Idaho are *Tympanis hypopodia* Nyl. and *Dasyscypha* (?) *calyciformis* [*R.A.M.*, xvii, p. 422]. Organisms of this type are believed to play an important part in arresting the spread of the rust through the reduction of aecidial sporulation.

McKenzie (M. A.). **Experimental autoecism and other biological studies of a gall-forming Peridermium on northern hard Pines.**—*Phytopathology*, xxxii, 9, pp. 785–798, 2 figs., 1942.

The experiments herein fully described, dating from 1932 and 1934, relate to the inoculation of nursery stock of *Pinus sylvestris*, *P. banksiana*, and *P. rigida* with the aecidiospores of a gall-forming bark rust, provisionally referred to *Cronartium quercuum* [*R.A.M.*, xv, p. 124], collected in New York State and Massachusetts on the two last-named hosts. The binucleate spores were enclosed in aecidia produced by uninucleate mycelia, and germination was consistently effected by means of germ-tubes, neither basidia nor secondary spores having been observed. All the inoculated trees (12 of *P. sylvestris* and six each of *P. banksiana* and *P. rigida*) contracted infection, but galls were only formed on *P. sylvestris* into which aecidiospores from *P. banksiana* were introduced, the other hosts merely developing slight roughening, swelling, or discoloration of the cortex. Neither aecidia nor pycnidia appeared on the galls induced on *P. sylvestris*. The histological examination of the diseased bark revealed the presence of typical rust mycelia and haustoria. Microchemical tests on sections from the borderline of the advancing mycelium disclosed an abundance of starch, fat, resin, and tannin in recently infected tissues and those adjacent to them: after a lengthy period of infection the tannin content of the cells underwent a marked decrease.

In addition to cortical discoloration, galls, and profuse mycelial and haustorial production, some of the inoculated trees developed witches' brooms, while others sustained defoliation and death of the leaders or complete necrosis.

Trendelenburg (R.). **The reduction in time required for fungus tests on wood by means of impact bending tests.**—*Holz Roh- u. Werkstoff*, iii, pp. 397–407, 1940. [German. Abs. in *Chem. Abstr.*, xxxvi, 18, pp. 5628–5629, 1942.]

Wood-destroying fungi affect most strength properties of the substratum more rapidly than the weight. A method of testing preservatives is described involving the measurement of reduction in strength under impact bending after 30 days in preference to the estimation of loss in weight after four months. Two pieces, 8·5 by 8·5 by 120 mm., are exposed for 30 days to fungus cultures in Kolle flasks, then dried and broken, as also are two controls kept for the same period under humid but sterile conditions. Loss in strength up to 80 per cent. is obtained as against a reduction in weight of 10 per cent. This technique is equally applicable to tests of the natural resistance to decay of different kinds of wood.

Proceedings of the American Wood Preservers' Association, 1942.—610+xlvi pp., 1 pl., 76 figs., 56 graphs, 3 maps, Washington D.C., American Wood Preservers' Association, 1942.

This report of the 38th annual meeting of the American Wood Preservers' Association, held at Minneapolis on 27th, 28th, and 29th January, 1942, includes the report of a number of separate committees, dealing with preservatives, co-ordination and standardization of treatment specifications, the painting of creosoted wood, pressure and non-pressure treatments, and the uses of treated wood.

Mae S. Chidester, describing experiments on the effect of *Trichoderma lignorum* [*T. viride*] on loblolly pine (*Pinus taeda*) sapwood states that two wood-inhabiting strains of the fungus, when inoculated into *P. taeda* sticks, which were then placed in a room with 97 per cent. relative humidity, caused a consistent though slight reduction in fibre stress at proportional limit, modulus of rupture, work to proportional limit, work to maximum load, total work, and maximum crushing strength after one and three months' incubation; they caused no reduction in specific gravity or modulus of elasticity.

V. F. Hribar, dealing with the corrosion resistance of wood-preserving plant metals (pp. 171–206), states that corrosion is measured by loss of weight, visual observation, depth of pitting, or tensile strength, and presents a series of tables and photographs showing loss in weight (expressed in mg. per sq. in.) and the visual appearance of different metals for three types of immersion, (*a*) alternate, (*b*) partial, and (*c*) complete. From the tables given, readers can study their own particular problem, comparing the loss in weight of one metal for different preservatives and water at different temperatures.

W. McMahon, C. M. Hill, and F. C. Koch, describing greensalt, a new preservative for wood (pp. 334–348), its performance under test, and the technical aspects of its application, state that the name covers various mixtures of chromates, copper compounds, and arsenic acid. The composition chiefly studied by the writers is greensalt K. This consists of five parts of potassium dichromate, three of copper sulphate, and one of arsenic acid.

The resistance to decay of wood treated with this preservative was tested both in the field and in the laboratory. Small southern yellow pine [*Pinus* spp.] saplings about 1 in. in diameter and posts of the same wood 4 to 5 in. in diameter were treated with various concentrations and exposed in test plots, where they were kept under observation for seven years. Results with sapling tests showed 100 per cent. sound after seven years for 1 lb. per cu. ft. retention, as against 0 to 20 per cent. sound for four creosotes conforming to A.W. P.A. Grade 1 specification at 4 or 8 lb. per cu. ft. retention after five years. Laboratory tests demonstrated that while wood treated with greensalt is not completely immune from attack by some wood-destroying fungi under conditions ideal for decay, it compares well under similar conditions with wood treated with other preservatives.

G. Q. Lumsden & A. H. Hearn, describing the greensalt treatment of poles (pp. 349–364), state that the first commercial treatments under the supervision of the Bell Telephone laboratories were made in 1940, and by 1941 the preservative was recommended for the treatment of telephone poles for regular use. One advantage of greensalt-treated poles is that they are clean and can be painted readily. Following tests in 1938, a specification for greensalt-treated southern pine poles was drawn up, and arrangements were made with the telephone companies to instal about 2,400 treated poles. The specification contained four essential requirements: (1) the poles should be well air-seasoned before treatment; (2) penetration should be at least equal to that of the 8 lb. empty-cell creosoted pole; (3) the empty-cell process should be employed; and (4) retention should be a minimum of 1 lb. dry salts per cu. ft. wood. During 1941 some 15,000 southern pine poles were treated under this specification.

J. P. Wentling, reviewing developments in treating western red cedar [*Thuja plicata*] (pp. 409–418) poles, states that the latest and most promising developments in non-pressure, full-length treatment consist in the use of pentachlorophenol as a toxic agent, with a light distillate oil as a solvent and carrier. Made up ready for use, the treating solution consists of 90 per cent. solvent-carrier oil, 5 per cent. pentachlorophenol, and 5 per cent. plasticizer, added to prevent crystallization of the chemical on the pole surface. The solution is stable, and may be stored indefinitely.

J. J. Reid, in a study of several products of disco type low-temperature coal tar as wood preservatives (pp. 435–450), states that the disco process of low-temperature

carbonization of coal produces a kind of tar from which two types of wood preservative can be obtained. One is a brown, aqueous alkaline solution of high-boiling compounds, mostly relatively insoluble tar acids, which, impregnated into wood, acts as a non-bleeding preservative, a great part of which does not leach out under severe test conditions. The other is disco creosote, a distillate similar to the creosote from low-temperature carbonization. Tests established the effectiveness of adequate treatment with the former, while the latter compared favourably with high-temperature creosotes.

R. K. Helphenstine, reviewing the quantity of wood treated and preservatives used in the United States in 1941 (pp. 498–522) [cf. *R.A.M.*, xxi, p. 109], states that the wood-preserving industry consumed 215,467,780 gals. creosote, including creosote coal tar solution, an increase of 23·39 per cent. over the figure for 1940. The industry used 1,403,863 lb. 'straight' and 4,382,561 lb. chromated zinc chloride, 1,656,014 lb. Wolman salts, 268,795 lb. zinc-meta-arsenite, and 310,921 lb. celcure.

G. B. Shipley (pp. 534–559) gives a comprehensive review of the lumber, sleeper, and wood-preserving industry in the United States from 1890 to 1940.

The preservative treatment of fencing posts.—*N.Z.J. Agric.*, lxv, 2, pp. 85–91, 1942.

In this paper (contributed by the New Zealand State Forest Service) on the preservative treatment of fencing posts attention is drawn to the fact that, in the first place, only sound and properly seasoned wood should be treated. The preservative recommended is creosote, particularly the grade known as British Engineering Standard Specification oil. Brushing and dipping are inadequate; appropriate soakings are necessary. Tar is not recommended.

The open-tank process is the best for farm use. The simplest equipment consists of two 90 gal. steel drums, approximately 3 ft. 4 in. high and 2 ft. 4 in. in diameter. One is used for the hot bath, the other for the cold. They may be mounted on bricks, with a flue, or placed over a fire-pit dug in the ground. The posts are soaked in a drum of creosote at 180° to 200° F., and then transferred to 'cold' creosote (about 100°). The hot and cold effect may be secured by leaving the posts in the hot creosote and allowing it to cool off during the night. If necessary the oil should be re-heated to 100° before withdrawing the posts. The duration of immersion varies with the species and the amount of penetration and absorption required. The whole of the sapwood of the part in contact with the ground should be impregnated if possible, though a penetration of ½ to 1 in. may be acceptable. Lighter penetration is sufficient for the rest. Under these conditions a post absorbs ½ to 1 gal creosote.

A table is given showing the period of immersion required for different species of wood.

Distribution maps of plant diseases.—Maps 1–24. Issued by the Imperial Mycological Institute, 1942. 3*s*. 9*d*. (3*s*. 0*d*. to direct subscribers in the British Commonwealth).

The first year's issue of this series of maps showing the world distribution of major crop diseases comprises (1) *Synchytrium endobioticum* on potato, (2) *Erwinia amylovora* on apple, pear, loquat, etc., (3) *Xanthomonas vasculorum* on sugar-cane, (4) *Oidium heveae* on *Hevea* rubber, (5) *Hemileia vastatrix* on coffee, (6) *Cronartium ribicola* on pines and *Ribes*, (7) *Cercospora musae* on banana, (8) tomato spotted wilt on tomato, tobacco, pineapple, &c., (9) *Omphalia flavida* on coffee, (10) *Claviceps purpurea* on rye and other cereals, and grasses, (11) *Xanthomonas citri* on citrus, (12) *Urocystis cepulae* on onion, (13) *Monilia roreri* on cacao, (14) *Pseudoperonospora humuli* on hops, (15) *Phymatotrichum omnivorum* on cotton, (16) *Sphaerotheca mors-uvae* on *Ribes*, (17) Fiji disease of sugar-cane, (18) *Sphaerella linorum* on flax, (19) bunchy top of banana, (20) *Corynebacterium sepedonicum* on potato, (21) *Sclerospora sacchari* on sugar-cane, (22) *Sclerotinia fructigena* on apple, (23) *Peronospora tabacina* on tobacco, and (24) curly top of beet.

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JAHN (E.). **Über die angeblichen Arten des Hausschwammes.** [On the so-called species of dry rot.]—*Ber. dtsch. bot. Ges.*, lix, 6, pp. 233–245, 1941. [Abs. in *Holz Roh- u. Werkstoff*, v, 6, p. 211, 1942.]

Falck's four species of dry rot, namely, *Merulius domesticus* [*M. lacrymans*], *M. silvester*, *M. minor*, and *M. sclerotiorum* [*R.A.M.*, xvii, p. 216] are critically discussed. *M. silvester* is regarded as the 'wild' form of the true dry rot (*M. lacrymans*), which is not nearly as destructive as the latter at room temperature (20° C.), but was experimentally shown to be much more so at 15° to 16°. 'Wild' or 'sylvan' forms of well-known wood-destroying fungi are stated to be capable of intensive rotting at higher or lower temperatures than those normally prevailing in buildings. *M. silvester* is a physiologic race of *M. lacrymans*, *M. minor* an immature aberrant type of the same, and *M. sclerotiorum* a synonym of *M. hydnoides* P. Henn. The copious production of water by *M. silvester* in cultures at room temperature is attributed to the intensive secretion of liquid by the fungus as a result of adverse temperature conditions. There is also a 'wild' form of *Coniophora* [*puteana*] with quite different temperature curves.

HURYCH (A.). **Wood petrified with limonite. The use of limonite for the preservation of wooden objects and wooden structural work.**—*Plyn, Voda Zdrav. Tech.*, xx, pp. 69–70, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxvi, 18, p. 5628, 1942.]

Spruce and pine timbers were protected from splitting and rotting by impregnation with a dilute solution of limonite, which penetrated deep into the pores and mineralized the wood. A thick slurry of the preparation (which is available commercially either as a liquid or paste) was then applied to the surface, where it hardened to a solid, tough, protective layer. The process should preferably be applied to the finished structure, which if necessary can subsequently be ground down and polished. The cost of the treatment does not exceed that of three coats of oil paint.

HOPKINS (J. C. F.) & PARDY (MARIE H.). **Diseases of fruit, flowers and vegetables in Southern Rhodesia. 6.—Virus diseases of Cabbages and Cauliflowers.**—*Rhod. agric. J.*, xxxix, 5, pp. 376–383, 17 figs., 1942.

A mosaic disease of cabbage in Rhodesia is stated to be either identical with or closely related to that described from Wisconsin [*R.A.M.*, xix, p. 65]. The earliest symptom is a marked yellowing of the veins followed by veinbanding and mottling. The leaf tips bend sharply outwards and downwards and the blades on each side of the midrib grow more vertically upwards than is normal. Later on, veinbanding becomes less distinct, growth is much retarded, heads fail to form, older leaves are shed, and dead areas and small black necrotic spots develop on the younger ones. The virus was experimentally transmitted by juice inoculation and by the aphids *Myzus persicae* and *Brevicoryne brassicae* to cabbage, cauliflower, and kohlrabi. The disease was favoured by high temperatures: in the greenhouse it developed best at 75° to 95° F. and was almost suppressed below 65°.

Dwarfing disease of cauliflower in Rhodesia is so named because it causes a severe dwarfing of the curds and often, but not invariably, of the whole plant. In the field, mottling is very prominent, followed by marked leaf distortion, minute raised blisters appearing on the under surface of the older leaves corresponding to minute, light tan-coloured spots on the upper side. In transmitted light such leaves can be seen to contain large numbers of translucent, yellowish spots and circles. Later a stipple of minute, black dots is formed on the under side, giving it a grey colour against which black spots stand out. In the late stages of the disease the severely distorted leaves with pronounced veinbanding are shed, the dwarfed and often loose curds becoming rapidly discoloured. Such curds are evil-smelling when cooked. The disease is favoured by low temperature and is suppressed above about 65°. The disease is transmitted to cabbage, cauliflower, and *Nicotiana glutinosa* by the same means as the cabbage disease. It does not resemble any of the known virus diseases and is believed to be due to either a hitherto undescribed virus or a mixture of viruses, one of which is possibly active in hot and another in colder weather. For the control of both the cabbage and the cauliflower disease it is essential to keep the beds free from weeds and old plant refuse and to practise roguing and spraying of the seed-beds. Weekly spraying with tobacco extract (1 in 500) and soap plus lead arsenate (3 lb. per 100 gals. wash) up to the time the plants were hearting helped to raise good marketable cabbages of the quicker-growing varieties, e.g., Early Jersey Wakefield and Copenhagen Market; the slower-growing, larger types were not so satisfactory and are not recommended for growing during the hot months.

Jones (R. A.). **Phosphorus deficiency blight for [of] Beets.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 66–68, [no date].—[Abs. in *Int. Sug. J.*, xliv, 523, p. 189, 1942.]

In 1926, a field of sugar beets in the Wheatland (Wyoming area) was observed to be dying. Normal growth was, however, found along certain irregular strips where refuse clover had been placed and burnt before the field was ploughed for the beets. It was assumed that the trouble was due to some deficiency supplied by the clover ash, and later on proof was obtained that it was in fact caused by phosphorus deficiency [cf. *R.A.M.*, xvi, p. 649; xxi, p. 278]. The first noticeable symptom of the condition, which is referred to as 'black heart blight', is a slight burning round the edge of the leaf, the tissues between the veins dying as injury progresses. It is found only in extremely deficient soils, representing a small percentage of the total beet area in the locality concerned, and is corrected by treble superphosphate application alone.

Bockstahler (H. W.). **Resistance to Fusarium yellows in Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 191–198, 1940. [Abs. in *Sugar*, xxxvii, 10, p. 43, 1942.]

Fusarium conglutinans var. *betae* is reported to have caused up to 50 per cent. reduction in seedling sugar beet [*R.A.M.*, x, p. 428] stands in Colorado, Western Nebraska, South Dakota, Wyoming, and Montana. The foliage is mottled, later yellow, curled, and distorted, and the roots are grey externally and show an internal grey or brown discoloration of the vascular bundles. The course of the disease assumes the character of a slow, dry rot. Progress has been made towards the development of resistant varieties.

Andrus (C. F.) & Wade (B. L.). **The factorial interpretation of anthracnose resistance in Beans.**—*Tech. Bull. U.S. Dep. Agric.* 810, 29 pp., 2 figs., 1 diag., 3 graphs, 1942.

At the Bureau of Plant Industry, United States Department of Agriculture, Washington, D.C., the authors studied from 1932 to 1938 the mode of inheritance of resistance to three physiologic races (beta, gamma, and delta) of bean (*Phaseolus vulgaris*) anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xi, p. 618; xiii,

p. 318], the first two supplied by W. H. Burkholder and the third (a new form) isolated from North Carolina material. Fifteen parent varieties and selections of differing reaction to the pathogen were used in 30 combinations, inoculations being made in the greenhouse on 145 F_1, 32,600 F_2, 108,000 F_3, and a considerable number of F_4 plants.

In the resistant × tolerant crosses, and reciprocal involving Perry Marrow, Boston Marrow, Canadian Wonder, and Geneva Red Kidney × Corbett Refugee, and Perry Marrow × Great Northern, resistance to beta was dominant, and this was also the case with resistant × susceptible and reciprocals (U.S. No. 1 Refugee, Selection No. 1, and Dark Red Mahogany × Geneva Red Kidney, Perry Marrow × U.S. No. 1 Refugee, and Canadian Wonder × Dark Red Mahogany). In two crosses of tolerant × susceptible (Dark Red Mahogany × Great Northern and the reciprocal) susceptibility was dominant. In the resistant × resistant crosses Robust × Small White and Small White × Boston Marrow all the progeny were resistant, while in No. 3 × Boston Marrow 99 were resistant and seven susceptible, approximating to a 15 : 1 Mendelian segregation. Similarly, certain susceptible × susceptible crosses yielded a few resistant individuals. Resistance in the tolerant × tolerant crosses (Great Northern × Corbett Refugee) appeared to follow a modified 13 : 3 ratio. Full particulars are also given of the results obtained with the gamma and delta races, and the conclusion is reached that a system of ten genes in three allelomorphic series, involving both duplicate and complementary genes for resistance, one dominant gene for susceptibility, and gene interactions at three points, is the simplest Mendelian hypothesis co-ordinating all the data for beta and gamma. A straightforward explanation (three independent pairs of genes) would fit the delta results, without necessarily excluding the more complex system. This hypothesis calls for 11 susceptible and 25 resistant parental genotypes, of which two of the former and five of the latter were apparently realized in the beta crosses alone. In the cross Corbett Refugee × Geneva Red Kidney and its reciprocal linkage was observed between the red seed-coat colour and susceptibility to races beta and gamma of *C. lindemuthianum*.

Sakr (El S.) & Thompson (H. C.). **Effect of infecting Carrot plants with certain viruses on seedstalk development.**—*Plant Physiol.*, xvii, 3, pp. 500–502, 1 fig., 1942.

In greenhouse tests carried out from 1939 to 1940 to ascertain the effect of temperature on seed-stalk development in carrots, certain yellowed plants formed seed-stalks earlier than others in the cool ranges of temperatures, while at the higher ranges (60° to 70° and 70° to 80° F.) they were the only ones that formed seed-stalks under some treatments. These plants were found to be infected with the eastern strain of aster yellows.

Inoculation of carrot plants with aster yellows induced the formation of seed-stalks which were not formed by inoculation with sap extract of either aucuba mosaic, latent virus of potato, lucerne mosaic, cucumber virus 1, or tobacco mosaic. No seed was set by the seed-stalks produced.

Thorne (D. W.) & Brown (J. C.). **Some characteristics of Utah chlorotic soils.**—Abs. in *Proc. Utah Acad. Sci.*, xviii, p. 11, 1941.

A survey of Utah County indicated that about 90 per cent. of the prevalent vine chlorosis [*R.A.M.*, xx, p. 557] is restricted to four soil series with profile characteristics similar to those of the Hyrum clay loam series, a study of a small area of which was accordingly conducted at the Agricultural Experiment Station to determine the factors associated with the disorder. The chlorotic patches were less thoroughly drained than the adjacent healthy ones and contained an average of 9 per cent. more lime in the upper foot. Considerably larger amounts of iron were extracted with 0·25 and 0·5 per cent. oxalic acid from non-chlorotic than from chlorotic soils. Iron

solubility would appear to be a function of the activity of lime as well as of the proportion of the latter in the soil.

MESTRES JANÉ (A.). **La lucha contra el mildiu.** [The anti-mildew campaign.]—*Agricultura, Madr.*, xi, 120, pp. 139–140, 1 fig., 1942.

According to an Italian estimate (March, 1941), the annual European consumption of copper for agricultural purposes, including the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*], amounts to 125,000 'toneladas' [1 'tonelada' = 20 quintals], of which the Spanish requirement is calculated by the writer at not less than 6,000. At Villafranca, one of the viticultural centres at which experiments in the use of copper substitutes are proceeding in connexion with the economy campaign [*R.A.M.*, xxi, p. 439], the following formulae have given satisfactory results against the disease: (1) 200 gm. copper sulphate per hl. plus gelatine; (2) 'eau céleste' (1 kg. copper sulphate per hl. rendered alkaline with ammonia); (3) copper ammoniate (25 gm. copper per hl. dissolved in ammonia); (4) Montpellier green (1·5 kg. basic copper acetate per hl. in suspension); (5) Menozzi's formula (1 kg. each of copper and iron sulphate per hl. made alkaline with lime) [ibid., xx, p. 622]; (6) copper oxychloride (1 kg. per hl.) preferably with an admixture of aluminium to secure adhesiveness; (7) copper-aluminium mixtures (1 kg. copper sulphate or oxychloride and 1·5 to 2 kg. aluminium sulphate per hl., made alkaline with lime); (8) Bruno mixture (1 kg. copper sulphate and 1·2 kg. trisodium phosphate per hl., made alkaline with sodium carbonate or lime); (9) Casale's mixture [ibid., xix, p. 581], known in Italy as ramital, which contains 200 gm. copper sulphate per hl. and has proved so efficacious that a Ministerial Commission authorized its widespread use in 1941 and large-scale production for 1942.

Memoria de los trabajos realizados por la Estación de Fitopatología Agrícola de La Coruña. Año 1941. [Report on the work performed at the Corunna Station of Agricultural Phytopathology during the year 1941.]—*Publ. Estac. Fitopat. agríc. Coruña* 20, 48 pp., 51 figs., 1 diag., 2 graphs, 1942.

P. URQUIJO LANDALUZE, continuing his investigations on chestnut ink disease (*Phytophthora cambivora*) [*R.A.M.*, xxi, p. 404], carried out comparative cultural studies of a local strain of the causal fungus isolated from *Castanea dentata*, walnut, and *Erica*, and the strains of Leonian and Petri, supplied by the Bureau voor Schimmelcultures, Baarn. According to their sporangial dimensions the strains were relegated to three groups, (1) Petri's and Leonian's, (2) the writer's local isolate (62·1 by 37·2 μ) and the walnut strain (63·6 by 40 μ), and (3) the *C. dentata* strain, Dufrénoy's strain [ibid., xiii, p. 336] and that from *Erica* (the subjects of earlier experiments) falling into the first and second groups, respectively. Spherical chlamydospores were produced by the local chestnut isolate and those from *C. dentata*, walnut, and *Erica*, but were uniformly absent from Petri's, Leonian's, and Dufrénoy's strains. Cultural studies of 538 isolates on various media clearly emphasized the differences between group (1) and groups (2) and (3).

Inoculation experiments were carried out on seedlings in nutrient solutions with pure cultures of the seven strains of *P. cambivora*, fragments of the mycelium of which were inserted through incisions into the hypocotyledonary axes or roots, the percentages of infection obtained with the local strain (comprising the bulk of the tests), Petri's, Leonian's, Dufrénoy's, and the isolates from *C. dentata*, *Erica*, and walnut being 99, 60, 85, 57, 100, 100, and 83 respectively. The copper oxychloride and copper carbonate treatments, already described, when applied to the roots of two-year-old transplants [ibid., xxi, pp. 434, 475] again proved efficacious: in the laboratory the lethal dose of the copper ion was found to be 1 in 100,000, the mycelium of the fungus failing to develop when re-sown on carrot roots after exposure to this concentration.

J. R. Sardiña compared two Spanish isolates of *Cytospora* sp. from chestnut [ibid., xxi, p. 404] with cultures of *Endothia parasitica* supplied by F. D. Heald and G. P. Clinton from the United States. The first-named differed from the others not only in pycnospore dimensions, but also in the production of a raspberry-coloured to carmine pigment on certain media, e.g., Richards's agar and Leonian's malt extract solution.

New records for the Corunna district include *Cronartium flaccidum* on peony, *Cylindrosporium mori* on mulberry, *Ovulariopsis haplophylli* (P. Magn.) Trav. on *Ruta graveolens*, *Puccinia* (?) *antirrhini* on *Antirrhinum majus*, *P. glumarum* on wheat, and the following grasses not hitherto known locally as hosts of *Claviceps purpurea*: *Holcus lanatus*, *Dactylis glomerata*, and *Brachypodium pinnatum*.

Zillig (H.). **Beiträge zur Adventivflora des Moselgebietes.** [Contributions to the exotic flora of the Moselle region.]—*Angew. Bot.*, xxiv, 3–4, pp. 352–393, 1942.

Among the items of interest in this survey of the exotic flora (including parasitic fungi, pp. 359–366) of the Moselle Valley may be mentioned the following. Tomato leaf mould (*Cladosporium fulvum*) is troublesome in wet seasons on outdoor plants as well as in the greenhouse. Little hope is entertained (September, 1941) of saving the white pine [*Pinus strobus*] stands attacked by *Cronartium ribicola* [*R.A.M.*, xv, p. 472], and this species will accordingly only be perpetuated in small plantings in *Ribes*-free districts. *Graphium* [*Ceratostomella*] *ulmi* has been present on elms in the vicinity of the Rhine and on the heights above Coblenz since about 1928 [ibid., xvii, p. 636], *Ulmus montana* and its hybrids being chiefly affected, though *U. campestris* is also liable to virulent infection. Direct control measures are impracticable and the removal of diseased trees is essential. The isolated local foci of potato wart (*Synchytrium endobioticum*) have been largely eliminated since their first appearance in 1926, and the exclusive cultivation of immune varieties [ibid., xix, p. 320] is expected to complete the process of extermination. A table is given showing the origin, hosts, year of first observation, and economic importance of the 17 pathogens enumerated.

Parham (B. E.). **Botanical note. Plant protection. (Notes from the Pathological Laboratory—III.)**—*Agric. J. Fiji*, xiii, 1, pp. 27–28, 1942.

In July, 1940, 'jak' (*Artocarpus integer*) trees near Naduruloulou were observed to be severely infected by *Rhizopus artocarpi* [*R.A.M.*, xii, p. 680], not hitherto recorded for the Colony. The young female inflorescences were covered with a grey, later black mass of sporangia surrounded by a paler fringe of immature sporangiophores. The rot progressed rapidly, causing mummification and shedding of the fruits within four or five days of its inception near the stem. Mechanical injury does not appear to be a necessary preliminary to infection.

A note is given on an outbreak of white rust (*Albugo candida*) [*Cystopus candidus*] on Chinese cabbage at Suva, where the disease was evidently favoured by the cool weather prevailing during June (average maximum and minimum temperatures 72° and 68° F., respectively), and the first fortnight of July (73° and 62°, respectively), the optimum for spore germination of the fungus and its maximum for growth being 56° and 77°, respectively. Preventive sanitary measures are briefly indicated.

Phytophthora hibernalis was first observed on orange fruits, causing the loss of an entire fruit crop, in 1941. Brief recommendations for control on the lines adopted in New South Wales [ibid., xix, p. 326] are given.

Plant pathology and physiology.—*Rep. Tex. agric. Exp. Sta. 1941*, pp. 64–73, 1942.

This report [cf. *R.A.M.*, xxi, p. 127] contains, *inter alia*, the following items of interest. In further work by W. N. Ezekiel on cotton root rot (*Phymatotrichum omnivorum*) evidence was obtained showing that losses attributable to infection may

be masked in average figures. The same increase in rainfall that conduces to the spread of root rot also encourages the growth of those cotton plants that have remained unaffected. Yield data made up by averaging yields from affected and unaffected fields can, therefore, conceal in the averages the losses caused by the disease. Percentage reduction in yield would appear to approximate to nine-tenths of the percentage of plants killed by the date of the first picking.

Successive transfer of young cultures of *P. omnivorum* resulted in a remarkable attenuation of the strain. The immediate cause, apparently, is neither accumulation in attenuated cultures of diffusible inhibitory materials (as a phage) nor lack of growth-promoting materials. The continued resistance (in greenhouse inoculation tests) of *Albizzia julibrissin* suggests that it is suitable for use in root-rot areas.

Ezekiel and Nelson found that root-rot prevalence can generally be reduced, in soils not too highly buffered, by applications of sulphur.

In studies of the growth reactions of *P. omnivorum* to amino nitrogens and of the absorption and utilization of inorganic nitrogen by the fungus [ibid., xxi, p. 287], Talley, Mason, and Blank found that arginine, alanine, asparagine, aspartic acid, glutamic acid, glycine, proline, and tyrosine were good sources of nitrogen, while moderate growth was obtained from cystine, leucine, iso-leucine, methionine, phenylalanine, and valine. Glycine anhydride, histidine, lysine, and tryptophane were poor nitrogen sources. Ammonium nitrate, nitrate salts, and ammonium salts were equally satisfactory as sources of nitrogen.

Eaton and Rigler found that the susceptibility of cotton plants to *P. omnivorum* is related to the carbohydrate levels in the root bark. In both field and greenhouse tests, fruitful, high-nitrogen plants with low concentrations of carbohydrates died within 10 days of inoculation, while low-nitrogen, defruited plants high in carbohydrates lived on. In a field experiment on Houston soil, autumn ploughing reduced the percentage of dead plants from 39 to 25·3 per cent. and increased yield by 36 per cent. The addition of 120 lb. nitrogen [? per acre] in autumn had no effect on root rot, but increased yields by 14 per cent. Spacing two plants every 28 instead of every 14 in. slightly reduced infection and slightly increased yield. In a new method of inoculating cotton plants with root rot Milo seeds are autoclaved and spread on plates of the fungus. Given numbers of the infected seeds are placed at uniform depths of about 1 in. from the tap-root, and the duration of the period elapsing between inoculation and death serves as a criterion of resistance.

A. L. Harrison placed six- to eight-week-old tomato plants in a spore suspension of *Alternaria solani* and then transferred them to a moist chamber for 24 to 60 hours. All varieties of tomato were found to be highly susceptible, while certain strains of *Lycopersicum pimpinellifolium*, *L. peruvianum*, and F hybrids of *L. esculentum* × *L. hirsutum* showed more resistance than any tomato variety tested. Grey spot (*Stemphylium solani*) [ibid., xii, p. 60] was prevalent on tomatoes in August and September, this being apparently the first record of the disease in Texas.

G. Ken Knight and A. L. Harrison state that four applications of a spray containing copper oxychloride and wheat flour (3–3–100) markedly increased the yield of cantaloupe melons during a severe epidemic of *Peronoplasmopara* [*Pseudoperonospora*] *cubensis*. Rather smaller yields were obtained with Bordeaux mixture (8–8–100) and with tribasic copper sulphate as a dust. Red copper oxide as a spray gave only slight yield increases and as a dust decreased yields.

A. A. Dunlap and E. W. Lyle, in experiments in co-operation with the United States Cold Storage Company, Dallas, designed to prevent excessive loss from neck rot [? *Botrytis allii*] in Bermuda white wax onions under cold storage conditions, found that considerable reduction in infection occurred when the onions were stored in wooden crates instead of sacks. Onions harvested during dry weather developed only 5 to 10 per cent. neck rot in storage, as against 20 to 50 per cent. among those harvested in rainy weather. Dusting with boric acid and sodium borate when storing

seemed to prevent neck rot and improved the appearance of the onions under cold storage conditions.

Watkins, H. F. Morris, and Langley state that after storage at 38° F. for $5\frac{1}{2}$ months, peaches that had been treated with sulphur sprays against brown rot [*Sclerotinia fructicola*] showed 68 per cent. sound fruits, as against only 33 per cent. for the untreated lots. In this connexion it is pointed out that control of the Oriental fruit moth [*Cydia molesta*] is of the first importance, since brown rot decay follows injury by this insect.

LYLE (E. W.). **Effect of crop rotation on crown-gall and root-knot in east Texas experiment with Roses.**—*Sth. Flor.*, lii, 8, p. 7, 2 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 244, 1942.]

Soil on which roses were severely attacked by crown gall [*Bacterium tumefaciens*] in 1937 was planted in the two following years with resistant crops, viz., Iron cowpeas, oats, and *Crotalaria*, half of the experimental area being replanted in December, 1939, with rose cuttings, some of which were treated with mercuric chloride (1 in 1,000). In October, 1941, about 3 per cent. of all the plants were infected by crown gall, as compared with 53 per cent. in 1937, the incidence of the pathogen on the treated and control cuttings being 0·97 and 5·66 per cent., respectively. Neither crop rotation nor disinfection was effective against root-knot nematodes.

FRIEDMAN (B. A.) & FRANCIS (T.). **Gall formation by Phytomonas tumefaciens extract and indole-3-acetic acid in cultures of Tomato roots.**—*Phytopathology*, xxxii, 9, pp. 762–772, 4 figs., 1942.

Excised tomato root tips, growing in nutrient solution enriched by indole-3-acetic acid at varying concentrations, developed galls resembling those produced by *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xv, p. 782; xix, p. 202] and characterized by hypertrophy of the cortical and epidermal cells, marked meristematic activity of those of the pericycle, resulting in abundant formation of root primordia, some multiplication of the cortical cells, the occasional appearance of multinucleate cells in the pericycle and cortex, excessive production of root hairs with frequent apical swellings, and stimulation of callus growth at the cut root ends. The higher concentrations of the growth substance induced extensive fragmentation of the epidermal and cortical cells, as well as thickening and irregularity of the roots. Up to dilutions of about 7×10^{-9} moles per l., indole-3-acetic acid inhibited root elongation, reduced the number of branches formed, and decreased the total dry weight, the approximate lethal dose, killing some 90 per cent. of the roots, being 5 mg. per l. The chemical galls persisted after transference to fresh nutrient solution, in which all new growth, however, was normal. Tumour formation could not be induced by the addition to the medium of tryptophane, indole, or acetic acid, or by varying the hydrogen-ion concentration of the controls.

MEAD (H. W.), RUSSELL (R. C.), & LEDINGHAM (R. J.). **The examination of cereal seeds for disease and studies in embryo exposure in Wheat.**—*Sci. Agric.*, xxiii, 1, pp. 27–40, 3 figs., 2 graphs, 1942.

A full account is given of routine laboratory tests of 817 samples of wheat, oats, and barley grown in Saskatchewan in 1940 [cf. *R.A.M.*, xx, p. 566]. The results with wheat agree in the main with those of the previous year. A severe type of smudge was caused by *Helminthosporium sativum*; it was much less common than the ordinary mild type prevalent in the newer varieties, the cause of which has not yet been ascertained. Bunt [*Tilletia foetida* and *T. caries*] was found on 8·3 per cent. of the samples, which had an average spore load of less than 10 spores per kernel. Under the local conditions, average spore loads of about 120 spores per kernel for wheat and

200 for oats and barley generally produce 0·1 to 1 per cent. bunted heads in the crop. With wheat, an infection of 5 per cent. or more in the field would probably cause the threshed grain to be graded as 'smutty'.

With oats (165 samples) an average spore load of about 500 spores of smut [*Ustilago avenae* and *U. kolleri*] per kernel was found on 66 per cent. of the Vanguard samples, the corresponding figures for Victory being 180 spores on 82 per cent., for Banner 60 on 50 per cent., and for Gopher 80 on 75 per cent. *Alternaria* sp. was present on all samples, and several showed the presence of *Rhizopus* sp. and *Penicillium* sp. *H. sativum* was fairly common on the oat kernels when they were incubated. *Fusarium* sp. spores were occasionally observed in centrifuged washings.

The 63 barley samples tested included the O.A.C. 21, Rex, Plush, Royal, Prospect, and Olli varieties. An average spore load of about 75 smut [*U. hordei* and *U. nuda*] spores per kernel was found on 25 per cent. of the samples in some varieties and 60 per cent. in others, Regal and O.A.C. 21 having most. *H. sativum* occurred on 18 samples and its highest incidence was 1 per cent. on O.A.C. 21. The fungus causes root rot of barley if a virulent strain is present on the seed, and causes smudge of barley seed. This discoloration was found in 40 samples to an average extent of 1·5 per cent.

Tests with wheat seed showing embryo exposure (due to fractures) for susceptibility to mould [unspecified] demonstrated that in almost every instance, samples with severe exposure, when placed under conditions of high humidity, rapidly developed greater mould growth than less severely injured samples. When damp Apex wheat seed with high and low embryo exposure (92 and 18 per cent., respectively), was stored for 24 days, the severely damaged samples underwent a rapid rise in temperature. At the conclusion of the tests, abundant growth of thermophilic fungi was observed, together with *Aspergillus* spp. and some *Penicillium*. Examinations at intervals during one test showed *Penicillium* first, followed by *Aspergillus* and thermophilic species. It was concluded from these tests that embryo exposure and concomitant troubles might cause serious damage when conditions were suitable for fungal growth.

When wheat seed showing various degrees of embryo exposure was treated with lunasan, formalin, and ceresan and planted at Saskatoon and Indian Head, in the latter locality excellent growing conditions tended to submerge differences as between degrees of embryo exposure and the various treatments. At Indian Head, formalin caused distinct decrease in emergence, but this was not always reflected in the yield. The mercury dusts in some instances improved emergence and yield. At Saskatoon, there was a slight but distinct difference between the high and low embryo exposure samples, mainly shown in the yield results. Thus, in the untreated lots of one test there was a difference in reduced emergence of only 1 per cent. between the sample with 15 per cent. embryo exposure and that with 85 per cent., while the yield showed a difference of 9 per cent. In the same test, the lunasan-treated samples showed a general increase in emergence, but with a difference of reduced emergence of 3 per cent. between the samples containing low and high embryo exposure; the yield for the same two samples showed a reduction of 18 per cent. A similar relationship resulted in another test, in which ceresan was used. It is difficult to account for the reduction in yield in relation to emergence in these tests. Apparently, growth became retarded following emergence, this being reflected in the depressed yield. This depression reaction was increased by the mercury dusts under conditions of limited soil moisture. With formalin there was an improvement as the season progressed, but reduction was marked with severely injured seed. Stress is laid on the importance of estimating the amount of injury carried by seed samples before proper seed treatment can be recommended.

Neatby (K. W.). **New varieties of spring Wheat resistant to stem rust in the Canadian West, and their genetical background.**—*Emp. J. exp. Agric.*, x, 40, pp. 245–252, 1942.

After referring to the fact that the problem of stem rust of wheat (*Puccinia graminis*) in the hard red spring-wheat area of Canada and the adjacent States has now, at least for the time being, been completely solved by the use of resistant varieties, the author briefly reviews the genetical phases of the breeding work involved, and shows how genetical research simplified the problem. The aspects of the matter dealt with cover the existence of 'groups' of physiologic races from which one wheat variety might be immune, 'mature-plant' resistance, not fully expressed until the heading stage or later, comparative field tests from 1935 to 1941 with Marquis, Apex, Renown, Regent, and Thatcher wheat, the use of breeding material from Manitoba and Kenya, and the distribution of the various resistant varieties in the prairie provinces.

In the comparative field tests at the Dominion Rust Research Laboratory, Winnipeg, during 1935 to 1941, inclusive, the figures for mean percentage stem rust infection for Marquis, Apex, Renown, Regent, and Thatcher wheats were, respectively, 68, 3, 1·3, 1·1, and 9·1 per cent.; the mean yields were, respectively, 11·5, 22·8, 27·8, 29, and 26·8 bush. per acre, while at Brandon, Manitoba, under conditions of natural infection, they were 24·7, 34·3, 38·1, 39·1, and 41·4 bush. per acre. In 1941, the varieties Thatcher, Apex, Renown, and Regent occupied 91·7 per cent. of the Manitoba wheat acreage and 79·2 of the Saskatchewan acreage. Thus, susceptible varieties have virtually disappeared from the 'rust area' since 1936. This 'rust area' occupies the central and southern part of the farming area of Manitoba, and southern and east-central Saskatchewan.

It is concluded that the solution of the stem-rust problem in the locality concerned is an achievement of outstanding merit. It has resulted from the combined efforts of breeders, pathologists, agronomists, and chemists. Quite apart from the immense economic benefits which have resulted, the work has also contributed very substantially to existing knowledge of the biology of *Puccinia* spp., the genetics of resistance, and factors affecting 'wheat quality' and its measurement.

Garcia-Rada (G.), Vallega (J.), Loegering (W. Q.), & Stakman (E. C.). **An unusually virulent race of Wheat stem rust, No. 189.**—*Phytopathology*, xxxii, 8, pp. 720–726, 2 figs, 1942.

A hitherto undescribed physiologic race designated No. 189 of *Puccinia graminis*, isolated from Khapli emmer in Peru [*R.A.M.*, xxi, p. 184], is distinguishable from every other known strain of the rust by its ability to attack all the differential wheats used for purposes of identification, as well as the otherwise uniformly resistant *Triticum timopheevi*, besides virulently infecting Hope, a generally resistant variety. The new race appears to be distributed along the Peruvian coast from Lambayeque to Lima, where it is suspected of having been present for upwards of 20 years, but has not been found elsewhere in South America or isolated from either wheat or barberry in the United States during a similar period. Particulars are given of the inoculation experiments conducted with race 189 in the greenhouse and field at St. Paul, Minnesota. The most important feature of the Peruvian isolate is its high degree of pathogenicity to adult plants of normally resistant varieties, including Khapli, which in extensive and exacting tests has withstood every spring wheat rust epidemic of the last 30 years with the minimum of infection, except that of 1916, and even then the pustules numbering about half those counted on the susceptible varieties, were small. The possibilities of dissemination of race 189 from Peru to other South American countries and the States are briefly discussed.

SALLANS (B. J.). **The importance of various roots to the Wheat plant.**—*Sci. Agric.*, xxiii, 1, pp. 17–26, 1 graph, 1942.

Further experiments were carried out in Saskatchewan from 1934 to 1939 to ascertain the relative importance of the seminal and crown root systems of wheat plants as determined by root amputations under ordinary crop conditions [*R.A.M.*, xii, p. 501]. The roots amputated were the true seminal roots, including the primary root, the first and second pair of lateral roots, the sixth seminal root, and the coleoptile axillary roots, sometimes classed as seminal roots.

The results demonstrated that when the various roots are well established they contribute independently of each other to the water and mineral supply of the plant, as indicated in the final yield of grain. The individual root that contributes most to the final yield is the primary seminal root, while the first pair of lateral seminal roots is about equally important. These three roots are almost always produced by seedlings growing under normal conditions. The second pair of seminals, the sixth seminal, and coleoptile axillary roots were found to be of considerably less use to the plant than the first three seminal roots. The contributions of the crown roots, while individually small, were generally larger in the aggregate than those of the seminal roots.

Browning root rot of wheat [*Pythium* spp.: ibid., xiv, p. 748] frequently causes an amputation of the crown roots by rotting the growing tip or a segment of the root behind the tip. A loss in the number of crown roots results, and from the findings in the present paper, there is a corresponding loss in final yield. The higher the percentage loss of crown roots, the greater is the loss in yield. The main axes of the seminal roots generally escape being rotted off but the lateral branches become severely rotted, the efficiency of the seminal roots being much reduced. The action of the fungus here is to amputate the rootlets rather than the main roots, but the effect is similar, as the effective absorptive surface is considerably diminished. The growing points remain active, and the roots continue to grow down into soil layers relatively or entirely free from the fungus. Hence, the plants may show a retarded recovery.

With take-all [*Ophiobolus graminis*] different degrees of root amputation may occur, the results ranging from a slight yield reduction to the death of the plant.

Common root rot (*Helminthosporium sativum* and *Fusarium* spp.) does not, as a rule, induce effective root amputation in Saskatchewan. There may be some reduction in the numbers of the lateral branches and in the number of seminal roots; there is much stunting and reduction of yield. Growth vigour is lessened, and if infection occurs before crown root formation, the number of such roots may be greatly reduced.

JOHNSTON (C. L.) & GREANEY (F. J.). **Studies on the pathogenicity of Fusarium species associated with root rot of Wheat.**—*Phytopathology*, xxxii, 8, pp. 670–684, 1942.

At the Dominion Laboratory of Plant Pathology, Winnipeg, greenhouse pot experiments were conducted to determine the relative pathogenicity to Marquis wheat seedlings and mature plants of 24 isolates of *Fusarium culmorum*, and one each of *F. redolens*, *F. oxysporum* var. *aurantiacum*, *F. avenaceum*, and *F. equiseti*, all common occupants of rotted wheat roots and of grain soils in Manitoba [*R.A.M.*, vii, p. 312; xvii, p. 668; xx, p. 353, *et passim*].

Of the *F. culmorum* strains, only one (38 isolated from wheat at Rhodes in 1932) was definitely pathogenic to both young and adult plants, causing disease ratings of 88 on the former and 59 on the latter, reducing the incidence of emergence in the seedlings from 82·2 to 40·1 per cent., the green weight of young and mature plants from 65·2 and 126·1 to 9·7 and 88·4 gm., respectively, and lowering the grain yield from 22·3 to 11·1 gm. per plant. *F. avenaceum* and *F. equiseti* were scarcely, if at all, pathogenic to the seedlings, but attacked the older plants to a considerable degree

(32·4 and 26·8 disease ratings, respectively, resulting in yield reductions from 22·3 to 15 and 16·7 gm., respectively) while *F. oxysporum* var. *aurantiacum* and *F. redolens* did not cause appreciable damage to either group. Field tests with these fungi gave essentially similar results.

The moisture content of the soil (40 or 60 per cent. of its water-holding capacity) did not significantly influence the virulence of the fungi under observation, but the pathogenicity of *F. culmorum* increased with rising temperatures from 10° to 25° C. whilst *F. avenaceum* was pathogenic (but only weakly) at 25°, and *F. redolens*, *F. oxysporum* var. *aurantiacum*, and *F. equiseti* were not pathogenic at any temperature tested. In pot tests, *Trichoderma lignorum* [*T. viride*] and *Pyronema confluens*, both common inhabitants of the soil, noticeably lowered the pathogenicity of *F. culmorum* 38, especially at 10°, whereas *Penicillium imbricatum* and *Aspergillus flavipes* exerted no adverse effect on the infective activity of either *F. culmorum* or *F. redolens*.

Harris (R. H.) & Sibbitt (L. D.). **The quality of North Dakota durum Wheat as affected by blight and other forms of damage in 1940.**—*Cereal Chem.*, xix, 3, pp. 403–410, 2 graphs, 1942.

A tabulated account is given of the writers' preliminary investigations at the North Dakota Agricultural Experiment Station to determine the extent of the damage to processed durum wheat (semolina and macaroni) resulting from 'black point' (*Alternaria* spp. and *Helminthosporium sativum*) and other fungal infections, including scab (*Gibberella*) [*zeae*: *R.A.M.*, xx, p. 524].

It was found that slightly injured kernels, in which discoloration is confined to the tip, could be tolerated in a proportion up to 10 per cent. with good milling durum, while 25 per cent. does not appreciably impair the colour of macaroni or increase 'speckiness' in semolina. On the other hand, an incidence of 50 per cent. would entail a very high risk in the mill mix.

A more critical situation arises with the inclusion in the blend of heavily damaged kernels, the presence of 5 per cent. significantly increasing 'speckiness' in semolina and decreasing the macaroni score, 10 per cent. being highly detrimental, and 50 per cent. resulting in grade reduction from No. 1 Hard Amber to Sample Grade, which would involve the grower in a serious financial loss.

Zazhurilo (V. K.) & Sitnikova (Mme G. M.). **Взаимоотношение между вирусом мозаики озимой Пшеницы и его переносчиком—полосатой цикадкой (Deltocephalus striatus L.).** [The relation of the virus of winter Wheat mosaic to its vector (*Deltocephalus striatus* L.).]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 11, pp. 27–29, 1941.

In experiments carried out in 1940 at the Plant Protection Station, Voronezh, the virus of winter wheat mosaic [*R.A.M.*, xxi, p. 251] was successfully transmitted through *Deltocephalus striatus* [ibid., xx, p. 387], but not through *Delphax striatella*, *Cicadula sexnotata*, *Eurigaster integriceps*, *E. maurus*, *E. austriacus*, *Aelia acuminata*, or *Haplothrips tritici*. *Deltocephalus striatus* transmitted the virus from winter wheat to winter and summer wheats, oats, barley, rye, and millet [? *Panicum miliaceum*] and from some of these hosts to others, indicating that mosaic in all these hosts was caused by the virus of winter wheat. The incubation period of the virus in the insect (average of 75 insects) varied from 5 to 35 days, but was mostly 15 to 16; in the plant, after infection, it varied with the air temperature, lasting 22 days at a daily average of 10° to 15° [C.], 15 at one of 15° to 20°, nine at one of 20° to 25°, and up to 25 or 30 at temperatures below 10°. The insects retained their infectivity for a considerable time: 78·6 per cent. for five days, 7·9 per cent. for 40, and individual insects for as long as 60. Insects of both sexes and in all stages of development were capable of transmitting the virus, but only the first three larval stages were receptive to it.

In general, long feeding times were essential for the insects to become infected; thus, 6·5 per cent. of the larvae in the first stage became infected after 24 hours, 11·7 per cent. after two days, and 51·4 per cent. after five, but in no case did all the feeding insects become infected. The progeny of infective females was sterile, indicating that the virus was not transmitted through the eggs. These results lend support to previous conclusions that contact must be avoided between sources of infection in the field (stubble of spring cereals) and newly hatched generations of the vector, of which the most dangerous is the third, for it transmits the disease to the young stands of winter wheat where the virus overwinters. It is, therefore, of the greatest importance to destroy the infected stubbles by deep ploughing immediately after the harvest of spring crops and before the emergence of winter wheat.

Galachian (P. M.). К проверке патогенности штаммов **Bact. atrofaciens McCull.** в лабораторных условиях. [Testing the pathogenicity of strains of *Bact. atrofaciens* McCull. under laboratory conditions.]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow*, vi, 11, pp. 40–43, 3 figs., 1941.

In tests conducted during 1939 and 1940 at the Laboratory for bacterial diseases of the Pan-Soviet Institute of Plant Protection, Moscow, all but five of the over 70 strains of *Bacterium* [*Pseudomonas*] *atrofaciens* isolated from glumes, grains, and leaves of wheat [*R.A.M.*, xv, p. 669] and barley proved pathogenic to wheat and barley, respectively. The quickest and most effective method of testing the pathogenicity of the organism under laboratory conditions was to inoculate 24 hours' old agar cultures of the bacterium into the shoots and leaves with the help of a sterile needle. The strains varied in their virulence, the most pathogenic causing lesions on shoots 48 to 72 hours after inoculation and on the leaves after three to five days. Inoculation of the more virulent strains from wheat into barley and similarly from barley into wheat plants gave positive results. When inoculated into slices of potato the organism produced a rotting within 5 to 14 days. In comparative tests with other fluorescent bacteria, all the eight strains of *P. atrofaciens* tested proved pathogenic to shoots and seedlings of wheat and barley and to slices of potato, whereas *Bact.* [*P.*] *fluorescens*, *Bact. xanthochlorum* [*P. xanthochlora*], and *Bact. tabacum* [*P. tabaca*] produced no infection whatever.

Mead (H. W.). **Host-parasite relationships in a seed-borne disease of Barley caused by Helminthosporium sativum Pammel, King, and Bakke.**—*Canad. J. Res.*, Sect. C, xx, 10, pp. 501–523, 3 pl., 4 figs., 2 diags., 1942.

Histological studies of barley kernels naturally infested in the field with *Helminthosporium sativum* showed that mycelium was present in all the seed coverings except the innermost layer of the pericarp on the neutral side of the kernels. It was usually present towards the ends, especially the proximal end, where most of the discoloration occurs. The superficial mycelium was mostly dark, thick-walled, and highly septate, and contained protoplasm. It was present on the surface of, between, and within the cells of the various seed coverings. Points of penetration of the outer epidermis of the pericarp were recognizable as small translucent spots surrounded by areas staining red in acid fuchsin. Invasion of the cells did not appear to kill them immediately, but most of the invaded cells had collapsed, and contained a brown deposit. There was some indication also of cell reaction in advance of the hyphae. Mycelium was seen in the remnants of the lodicules. Spores were found between the lemma and palea where the glumes overlap. Many had germinated and produced mycelium which grew inwards over the pericarp and outwards over the palea.

Observations on kernels from experimentally inoculated heads indicated that if inoculation of hulled barley kernels by a virulent form of the fungus occurs at or shortly after flowering, the ovaries die, and the other parts of the spikelet become

infected. If inoculation occurs five to ten days later, the glumes, pericarp, and lodicules are invaded, and areas of brown, dead tissue develop, which contain a thick-walled, highly septate mycelium. Hyphal penetration beyond the inner integument was not observed. Infection of 15 to 20 days old kernels was limited chiefly to the pericarp and the parenchyma of the glumes at both ends of the kernel; there was no shrivelling at this stage.

When affected kernels and seedlings were studied during germination, five degrees of infection were observed: (1) complete blighting of plumule and radicle at a very early stage, (2) early blighting of the unemerged shoot with infection soon spreading to the roots, (3) post-emergence blighting of shoots and roots, (4) stunting due to basal infection, and (5) surface lesioning of shoot and roots with fairly strong growth. The fungus was also ascertained to spread from the seed into the adjacent soil to a limited extent.

Further evidence demonstrated that when seed-borne, *H. sativum* is able to cause injury to barley seedlings under a somewhat wide range of temperature conditions, if in the presence of sufficient moisture to give good growth. Seedling blight was the most serious injury, but light infection also spread over the base of the plants, involving the roots, sub-crown internode, and leaves. In most cases, severe early infection caused stunting and early death. In general, there was considerable recovery from the effects of infection, where competition for moisture was not severe. Even when the extent of seed infection was known, it was not possible to predict the amount of injury that would ensue, for this seemed to involve various factors affecting host and parasite.

SEMENIUK (W.) & ROSS (J. G.). **Relation of loose smut to yield of Barley.**—*Canad. J. Res.*, Sect. C, xx, 10, pp. 491–500, 3 graphs, 1942.

In a study of the effect of barley loose smut (*Ustilago nuda*) on yield the authors devised a method of inoculation by which infected spikes of Rewal barley (C.A.N. 1089) were allowed to dry overnight in the laboratory at room temperature, then ground up and passed through a 144-mesh fly screen. The sifted inoculum was placed in a four-layer cheese-cloth bag, and the chlamydospores scattered by hand over the barley heads, when these first emerged, early in July. This dusting process was carried out every evening for a fortnight, until all but the latest tillers had headed, four quarts of chlamydospores being used on about 80 sq. yds. of plants. At harvest, the youngest and consequently uninoculated spikes were pulled out and discarded. Greenhouse tests of the infected seed lots produced in 1938 and 1939 showed 15·5 and 33 per cent. infection, respectively. The seed so obtained was mixed with various proportions of normal, healthy seed to make samples with different percentage levels of affected seed, and these mixtures were planted in replicated field trials at three stations in each of two years. The relationship of yield to percentage of loose smut was then determined.

In the 1939 trials, no significant correlations were obtained between yield of barley and percentage infection. In 1940, however, a direct linear relationship was established between percentage incidence of loose smut and reduction of yield, yield being reduced for every 1 per cent. increase in infection by 0·85 per cent. at St. Paul, Minnesota, 1·4 per cent. at Edmonton, and 1·2 per cent. at Fallis, Alberta. These regression coefficients are not significantly different.

Infection did not appear to affect tillering. At all three stations similar degrees of smut were obtained for comparable seed lots. As the rate of seeding was increased, higher infections resulted. At Edmonton, incidence was the same on the basis of percentage affected spikes as on the basis of percentage affected plants.

Miles (L. E.) & Epps (J. M.). **The downy mildew disease of Oats, caused by Sclerospora macrospora.**—*Phytopathology*, xxxii, 10, pp. 867–878, 2 figs., 1942.

Sclerospora macrospora was collected on oats in Sunflower County, Mississippi, in the spring of 1939, this being the first record of the downy mildew for the State and its first occurrence on the host in question in the United States. The diseased plants were characterized by stiff, curled, and fleshy leaves, and a short, twisted rachis, producing few spikelets, and those mostly sterile; the panicles sometimes exhibited a scattered, drooping aspect, and the barren seed-like structures were markedly elongated and somewhat curved. Other features of the mildew included curtailment of the internodes, excessive tillering, and the development of numerous reddish-brown streaks and small ruptured areas from the bases to the tips of the leaves.

The few bearded wheat plants attacked by *S. macrospora* in an infested field of oats were much distorted and sterile, the abnormally elongated rachis frequently separating the spikelets and giving the head a loose appearance; in some cases the rachis was bent backwards so that the head formed a circle or compact knot. The awns were also curled and distorted. Oospores were abundant in the leaves, glumes, and awns.

The oospores of the fungus were found in all the aerial organs of the affected oats plants, especially the foliage and glumes, their average diameter (335 individuals) in 1939 and 1940 being 55·6 μ, the corresponding dimensions for two lots of 100 each from New South Wales being 58·6 and 61·8 μ, respectively. Oospores from collections of *S. macrospora* from wheat in Tennessee and Kentucky, Delaware, and various parts of Italy averaged 62·5, 60·9, and 59·6 μ in diameter, respectively. These figures agree reasonably well, irrespective of locality and host, but those for rice and *Syntherisma sanguinale* from Japan and for *Avena fatua* from New South Wales were much smaller, averaging 50·8 and 47·9 (two collections), 44·9, and 48 μ, respectively, while the corresponding figures for specimens from *Bromus commutatus* (Tennessee) and *Eragrostis major* (New South Wales) were 60·1 and 62·3 μ, respectively [cf. *R.A.M.*, xx, p. 457].

As regards the perpetuation of the pathogens, there is considered to be little doubt that it overwinters in infested soils through the agency of the oospores, which are invested and protected by a thick, hard, persistent wall, though germination of the oospore has not yet been observed. Dissemination from one locality to another is effected by means of trash, e.g., leaf and glume fragments, in the seed, and by wind and erosion.

Fawcett (H. S.), Bitancourt (A. A.), & Wallace (J. M.). **Wood alteration in psorosis of Citrus in relation to tree decline.**—Abs. in *Phytopathology*, xxxii, 9, p. 828, 1942.

In citrus psorosis A and B [*R.A.M.*, xx, p. 175], the primary lesions in the wood consist of gum in and between part of the vessels, while secondary injuries in the same site result in irregular discoloration and necrosis. The latter usually develop after the branch or trunk is girdled by the primary cortical and wood lesions. Suction experiments in drawing water or aqueous stains, e.g., 0·5 per cent. acid fuchsin or safranin, through the wood indicate that the primary lesions do not significantly impede the passage of water, whereas the secondary injuries, together with a region contiguous to that visibly affected, are impervious to the transit of fluid. These zones are co-extensive with those free from starch. Larger amounts of air were experimentally shown to pass through psorosis-diseased than through normal bark, in which the lenticels were the sole channels of slow air percolation. The obstruction of water passage by the secondary lesions appears to constitute the principal factor in tree decline. The alterations and discoloration of the central wood layers are probably a sequel to their starvation through the blocking by gum, in the primary wood lesions nearer the surface, of the inward passage of food.

BITANCOURT (A. A.) & FAWCETT (H. S.). **Statistical studies of distribution of psorosis cases in Citrus orchards.**—Abs. in *Phytopathology*, xxxii, 9, p. 827, 1942.

Most cases of citrus psorosis appear to be due to the utilization of buds from diseased parent trees [cf. *R.A.M.*, xix, p. 86], and the various operations from the collection of bud sticks to the final planting in the orchard usually afford ample scope for a thorough randomization. The comparison of the mean number of cases in the four trees adjacent to diseased and healthy ones, respectively, showed highly significant differences in seven orchards, a significant difference in one, and no significant difference in three. In those eleven cases there were more infected trees adjoining diseased than next to healthy ones. In an orchard with a very low incidence of psorosis, a non-significant difference was found in favour of the sound trees. The same analysis made independently for the two adjacent trees along rows and the two adjacent trees along arrays showed significant differences in both directions in five orchards, along rows only in one, and along arrays only in two. Systematic disposition of diseased trees along rows or arrays at planting time is thus indicated in the last three cases, while transmission from infected to healthy trees is the most plausible explanation for the five others.

CHAPMAN (H. D.) & BROWN (S. M.). **Potash in relation to Citrus nutrition.**—*Canning Age*, xxiii, 11, pp. 581–582, 1942.

Acute potassium deficiency in citrus induces twisting and crinkling of the leaves, the production of weak, flaccid, S-shaped lateral shoots, and the development on the foliage of vein-yellowing and yellow spots, markings, or stipplings. The marginal discoloration and scorching so common in other plants suffering from potassium deficiency are conspicuously absent.

Boron accumulated sufficiently in potassium-deficient lemon cuttings to produce the typical leaf patterns of boron excess, while leaf scorch from high sodium was somewhat accentuated in the test plants and transient iron chlorosis patterns on the foliage were also frequently observed. High calcium and magnesium in the culture solutions slightly expedited the appearance of potassium-deficiency symptoms, which were retarded (in an acute form), on the other hand, by high sodium. Though requiring further confirmation, a potassium content of less than 0·2 per cent. in leaves picked from July to September is probably indicative of deficiency, while 1 to 3 per cent. is an ample supply. The fruit from potassium-deficient trees, though small, was not of poor quality, whereas an excess of this element resulted in large, coarse, low-grade fruit susceptible to rot.

GILLETT (S.). **Results and observations of spraying trials using Bordeaux mixture on Coffee at the Scott Agricultural Laboratories.**—*Mon. Bull. Coffee Bd Kenya*, vii, 75, pp. 30–31, 1942.

This is a tabulated account and discussion of the results of an eight-year (1934 to 1941) series of experiments in the control of physiological leaf fall of Bourbon coffee by spraying with carbide Bordeaux mixture, the beneficial 'tonic' effect of which on the output of the treated trees presumably operates through the foliar assimilatory system, since no question of fungicidal action arises. Each of the eight experimental plots consisted of 49 trees and was surrounded by one unsprayed boundary row, the treatments applied being as follows: A, 1 per cent. carbide Bordeaux each year in March; C (B was omitted from the trial), the same in March and June; D, 0·5 per cent. in March; F, the same in March and June; E, control; G, 1 per cent. Burgundy mixture in March; H and I (1938 to 1941 only), 4 per cent. carbide Bordeaux at the rate of 2/5 pint per tree, applied with a fog sprayer once (in March) to the former and twice (March and June) to the latter. For the other five plots a power headland pump was used to spray at the rate of ½ to 1 gal. per tree.

The average yields (in cwt.) obtained from the eight-year series (plots A, C, D, F, G, and E) were 9·7, 9·4, 8·3, 10·4, 9·5, and 4·8, respectively, the first five representing percentage increases over the control of 102, 96, 73, 117, and 98, respectively. The two four-year plots H and I yielded 6 and 9·9 cwt., respectively, corresponding to percentage increases of 9 and 80 per cent., respectively, over the 5·5 cwt. of the control.

Fog spraying was introduced mainly with a view to overcoming the difficulty of water shortage and also on grounds of economy. Two applications by this method should not cost more than 10*s.* per acre or consume more than 50 gals. water, compared with 12*s.* to 15*s.* per acre and 400 gals., respectively, for the pump. The average increase in output from all the plots except H was 4½ cwt. clean coffee per acre, representing an additional gross income of £9 per acre, so that the extra expense of spraying is obviously negligible.

Pending the development of some more appropriate remedy for leaf fall, spraying in areas similar to those surrounding the Scott Agricultural Laboratories, embracing a large portion of the Kiambu coffee zone, appears to be not only economic but essential. Spraying resulted in superior leaf coloration and better retention, and the flavour of the finished product was not, in general, perceptibly impaired.

Di Fonzo (M. A.). **El tratamiento de la semilla del Algodonero con productos anticriptogamicos.** [Treatment of Cotton seed with fungicidal products.]—*Bol. Junta nac. Algodon, B. Aires, 1942*, 81–82, pp. 43–51, 1 diag., 8 graphs, 1942.

Full details are given of laboratory and field experiments (the latter in two widely separated districts of the Argentine, Chaco and Santiago del Estero) to determine the value of cotton seed treatment for the control of fungal diseases, especially those due to *Rhizoctonia* [*Corticium*] *solani*, *Glomerella gossypii*, and *Phytomonas* [*Xanthomonas*] *malvacearum* [*R.A.M.*, xxi, p. 417]. In both localities the best results were given by granosan No. 4 (8 gm. per kg.) closely followed by abavit 192 (universal), with germination percentages of 73·2 and 68·8, respectively, in Chaco and of 46·6 and 45·3, respectively, in Santiago del Estero, the corresponding figures for the two controls in each series being 58·2 and 46·3 and 41·4 and 40, respectively. Another factor liable to reduce the germinability of cotton seed, the moisture content of which under local climatic conditions averages 12 per cent., is infection by organisms of the yellow mould (*Aspergillus wentii*) [see next abstract] group. There was no reduction of germination in seed with an 8·5 per cent. moisture content after four months' contact with a fungicidal dust (4 to 12 gm. per kg.).

Di Fonzo (M. A.). **La humedad de la semilla del Algodonero relacionada con su poder germinativo y con la presencia del Aspergillus wentii.** [The moisture content of Cotton seed in relation to its germinative capacity and the presence of *Aspergillus wentii*.]—*Bol. Junta nac. Algodon, B. Aires, 1942*, 85–86, pp. 156–168, 3 figs., 9 graphs, 1942.

In laboratory experiments to determine the relationship of infection by *Aspergillus wentii* to the reduction of germinative capacity in cotton seed (Acala Blue Tag and Delta 11 A) of varying moisture contents, the fungus was found to assume an actively injurious form when the moisture content ranged from 11·2 to 15·2 per cent. Humidity alone was shown to be an important contributory factor to the loss of germinability in cotton seed, one lot of which, with an initial germinative capacity of 95·7 per cent., lost 33·5 per cent. in ten days in an Erlenmeyer flask containing sulphate to saturation (98 per cent. humidity), while the addition to the flask of inoculum of *A. wentii* resulted in a decline of 74·5 per cent. of germinative energy during the same period. Seed treatment with an approved fungicidal dust is a simple, economical, and effective method of protection against damage from this source.

ARMSTRONG (G. M.), HAWKINS (B. S.), & BENNETT (C. C.). **Cross inoculations with isolates of Fusaria from Cotton, Tobacco, and certain other plants subject to wilt.**—*Phytopathology*, xxxii, 8, pp. 685–698, 1942.

A tabulated account is given of cross-inoculation tests at the South Carolina Agricultural Experiment Station with the species of *Fusarium* isolated from cotton, tobacco, *Hibiscus esculentus*, tomato, watermelon, cowpea, and *Cassia tora*, carried out mostly by means of a solution-culture technique [*R.A.M.*, xx, p. 531] with some supplementary soil inoculations. The isolates from cotton, *H. esculentus*, *C. tora*, and Burley tobacco from South Carolina and Kentucky were reciprocally pathogenic, indicating the apparent involvement of a single fungus, to which, however, the flue-cured Gold Dollar tobacco variety was highly resistant. On the other hand, tobacco isolates from Maryland induced wilting of both types of tobacco, but not of cotton or *H. esculentus*. *C. tora*, a weed of cotton fields, was attacked by the agent of cotton wilt (*F. vasinfectum*). The species affecting tomato (*F.* [*bulbigenum* var.] *lycopersici*), watermelon [*F. bulbigenum* var. *niveum*], and cowpea [*F. tracheiphilum*] appear to be pathogenic only to their own or closely related hosts, since the tomato isolate was innocuous to watermelon, *H. esculentus*, and cotton, the watermelon strain failed to attack tomato, and the cowpea isolate caused no infection either of cotton or *C. tora*. The possible bearing of these data on the taxonomy of *F. vasinfectum* is discussed. Four attempts to differentiate culturally eight monospore isolates of *F. vasinfectum* by the technique of Coons and Strong, using malachite green and crystal violet dyes, gave inconsistent results. The authors conclude that the morphological studies so far recorded fall far short of providing a satisfactory method of identification for many of these fungi.

VERTINSKY (K. I.). **Food poisoning in Horses due to Stachybotrys alternans.**—*Sovetsk. Vet.*, *1940*, 5, pp. 61–68, 1940.

MOSELIANI (D. V.). **Stachybotrys infection in Horses.**—Ibid., *1940*, 10, pp. 42–44, 1940. [Russian. Abs. in *Vet. Bull.*, *Weybridge*, xii, 12, p. 577, 1942.]

Stachybotrys alternans, the agent of acute poisoning of horses first observed in the U.S.S.R. in 1935–6, was shown to multiply and produce toxin only in dead, moist fodder, well-dried cellulose substances with a moisture content below 20 per cent. being free from contamination.

PRATT (H. N.) & CROSSMAN (RUTH). **The comparative atopic activity of Alternaria spores and mycelium.**—*J. Allergy*, xiii, 3, pp. 227–230, 1942.

By direct testing of ten patients sensitive to *Alternaria* [*R.A.M.*, xxi, p. 452], a minimum of 95 per cent. of the atopic excitant in the spores was found to reside in the protein nitrogen, while further experiments on 25 persons of similar allergic constitution showed the spores to be at least ten times stronger than the mycelium in atopic excitant. Reagins were present for both spores and mycelium, but whereas mycelial extracts neutralized only reagins from the same source, conidial extracts consistently neutralized both spore and mycelial reagins. Extracts for the testing and treatment of atopic patients should, therefore, be prepared from the spores and not from the whole mat, which includes a quantity of incomplete mycelial antigen.

DUNCAN (J. T.). **Systemic mycoses.**—*Lancet*, ccxlii, 6187, pp. 393–395, 1942.

This is a review of the present status of knowledge concerning the symptomatology, etiology, geographical distribution, and therapy of the following systemic mycoses of man: coccidioid granuloma (*Coccidioides immitis*), Gilchrist's or Chicago disease (*Mycoderma* [*Blastomyces*] *dermatitidis*), sporotrichosis (*Sporotrichum schenckii* and *S. beurmannii*), torulosis (*Torula histolytica*) [*Debaryomyces neoformans*], pulmonary moniliasis (*Monilia* [*Candida*] spp.), and histoplasmosis (*Histoplasma capsulatum*), of

which *S. beurmannii* and the three last-named are known, and *B. dermatitidis* is suspected, to occur in England.

EMMONS (C. W.). **Coccidiomycosis.**—*Mycologia*, xxxiv, 4, pp. 452–463, 18 figs, 1942.

Coccidiomycosis, caused by *Coccidioides immitis* [*R.A.M.*, xx, p. 577; xxi, p. 417], occurs in a benign primary form and also as a grave, progressive disease. It is common in the San Joaquin valley, and probably occurs over large areas in the arid southwestern regions of the United States.

The newly disseminated spores in animal tissue or pus may be intra- or intercellular. As they enlarge, they retain their spherical shape. Budding has not been observed. A central vacuole can be seen in the early stages of enlargement and in older individuals it occupies most of the cell, the stainable cytoplasm being distributed in a thin peripheral layer. As the cell assumes the functions of a sporangium, the amount of peripheral stainable cytoplasm increases and becomes vacuolate. Cell walls are laid down along cleavage planes, delimiting an indefinite number of large protospores. The progressive formation radially and tangentially of additional septa subdivides the protospores into spores mostly 1 to 3 μ in diameter. The mature sporangium is filled with these spores. Its wall breaks, and they pass into the host tissues. This cycle is repeated, and constitutes the only parasitic growth phase of the fungus. The spores probably contain a single nucleus as a rule, but a multinucleate condition exists in the developing cell. Mitotic figures were not observed.

The saprophytic growth phase in culture is that of a mould. The grey or brownish-white colony may at first be glabrous, but aerial hyphae generally form in abundance in the centre and in a peripheral zone. The aerial hyphae may appear to break up into chlamydospores in old cultures, but if a five-day old culture is examined, it is seen that the spores are borne on well-differentiated conidiophores, which arise as specialized side branches nearly twice the diameter of the vegetative hyphae, and which may be simple or branched. Septa are formed at frequent intervals on the terminal portions of these conidiophores. Thus delimited, alternate cells increase in size and turgidity and in thickness of the wall. The intervening cells gradually cease development and lose their cytoplasm. The walls persist and hold the spores together in chains. It is suggested that these spores should be designated conidia or oidia rather than chlamydospores. As in the dermatophytes, spirally coiled hyphae are often present.

FLOR (H. H.). **Inheritance of pathogenicity in Melampsora lini.**—*Phytopathology*, xxxii, 8, pp. 653–669, 2 figs., 1942.

At the North Dakota Agricultural Experiment Station the author studied the inheritance of pathogenicity in flax rust (*Melampsora lini*) by selfing and hybridizing six physiologic races [*R.A.M.*, xxi, p. 80], viz., 6, 9, and 10, originating from uredospore collections made in Minnesota in 1934, 24 (uredospore, North Dakota, 1938), and 20 and 22, both from teleutospores, the former from Uruguay (1935) and the latter from the Argentine (1937). Of these, Nos. 10, 22, and 24 were apparently homozygous for pathogenicity, the infection types of each selfed culture being identical with those of its parent on the 11 differential varieties, while 6, 9, and 20 were heterozygous, some selfed cultures of each differing from the parent in pathogenicity on the test varieties.

Avirulence was invariably dominant in crosses between the physiologic races, though on Buda dominance was incomplete. The F_1 hybrid, therefore, resembled the weaker of the two parents in pathogenicity or united the less virulent characters of each. The range of pathogenicity of a uredinial culture does not necessarily indicate its genotype, the F_1 uredinial cultures of a cross between the virulent races 22 and 24, for instance, approximating in respect of infectivity to race 2, the scope of which is comparatively restricted.

The F_2 cultures of a cross between races 6 and 24 segregated for infection types on Buda, Akmolinsk, and Bombay, a process explicable on the assumption that two pairs of quantitative factors governed the pathogenicity of the hybrid to Buda, the single independent factor pairs, with avirulence dominant, were concerned in the response of Akmolinsk and Bombay, while the pair of factors determining the infection type on Akmolinsk was linked with one of those involved in the development of the rust on Buda. The ten physiologic races theoretically possible on the basis of this hypothesis were isolated, viz., 6, 14, 2, 24, and 33 to 38, inclusive, of which the last six had not previously been described.

The pathogenic characters of the physiologic races of *M. lini* obtained by selfing and hybridization could be accounted for by Mendelian segregation and the recombination of the qualities inherent in the parents. Pathogenicity of the selfed and hybrid cultures to Akmolinsk and Bombay, the reaction of which to the rust is governed by single factor pairs, was conditioned by single pairs of independent factors. In the hybrid between races 6 and 24, pathogenicity to Buda, which possesses two pairs of factors for resistance to the former, was dependent on two factor pairs, only one of these operating to determine the reaction of Buda of the heterozygous race 20. The selfed cultures of the last-named segregated for pathogenicity in a single factorial ratio when tested on Buda. These data suggest that the pathogenic range of each physiologic race of *M. lini* is governed by factor pairs specific for each resistant or immune factor owned by the host variety.

HOTSON (H. H.). **Some species of Papulaspora associated with rots of Gladiolus bulbs.**—*Mycologia*, xxxiv, 4, pp. 391–399, 1 fig., 1 graph, 1942.

From gladiolus corms attacked by *Sclerotinia* (*Botrytis*) sp. the author isolated four species of *Papulaspora*, *P. rubida*, *P. coprophila*, *P. appendicularis* Hotson, here described as new, and *P. dodgei* Conners (a name proposed for *P. gladioli* Hotson), and proved by inoculation that they were merely saprophytes in the tissue decayed by the primary infection.

Owing to the similarity of *Papulaspora* bulbils to the spore balls of *Urocystis* there has been confusion between species of *Papulaspora* and *U. gladioli* [*R.A.M.*, xx, p. 409] but, apart from more fundamental differences, the smut spore balls range from 12 to 32 μ in diameter while the ranges for the bulbils of *P. rubida*, *P. coprophila*, *P. dodgei*, and *P. appendicularis* are 20 to 48, 28 to 60 (mode 40), 24 to 64 (mode 44), and 32 to 100 μ, respectively.

In a note at the end of the paper D. L. Linder states that I. L. Conners (*in litt.*) has drawn attention to the fact that Hotson's name *P. gladioli* [ibid., xxi, p. 258] is a later homonym for *P. gladioli* Dodge & Laskaris [loc. cit.] and that it is to correct this error that *P. dodgei* is proposed.

CREAGER (D. B.). **Control program for Peony measles.**—*Flor. Rev.*, lxxxix, 2296, pp. 22–23, 2 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 244, 1942.]

The incidence of 'measles' or 'rust' infection on peonies [chiefly caused by *Cladosporium paeoniae*: *R.A.M.*, xix, p. 541] in Illinois was reduced to a substantial degree by the application of elgetol, a proprietary dinitro-ortho-cresylate compound, as a ground spray, indicating the practical possibilities of the preparation as part of a disease control programme.

CHILTON (S. J. P.). **Some pathogenic fungi occurring in the seed of Red and Subterranean Clover.**—*Phytopathology*, xxxii, 8, pp. 738–739, 1942.

Of 34 lots of surface-sterilized red clover (*Trifolium pratense*) seed under one year old cultured on potato dextrose agar at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, 19 were infected by *Pleospora herbarum* [*R.A.M.*, xx, p. 306], six by *Stemphylium sarciniforme* [ibid., xx, p. 583], one by

Cercospora zebrina [ibid., xix, p. 102], and two by the unidentified causal organism of 'black patch' [cf. ibid., xvi, p. 616]. The incidence of the fungi was not high, the maximum of *P. herbarum* in any lot being 2 per cent. and that for the other pathogens under 1 per cent. *P. herbarum* and *S. sarciniforme* were the only contaminants of viable seed, the species isolated from the remaining material under one year old (the 15 lots of two or more years yielded no fungi) including *Alternaria*, *Phoma*, *Fusarium*, *Penicillium*, *Oospora*, and *Chaetomium*. From one batch of 980 seeds of *T. subterraneum*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *Rhizoctonia* [*Corticium*] *solani*, and *F.* sp. were isolated four times, once, and five times, respectively.

MYERS (H. E.) & ANDERSON (K. L.). **Bromegrass toxicity vs. nitrogen starvation.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 770–773, 2 figs., 1942.

The results of a study at the Kansas Agricultural Experiment Station to ascertain the cause of the 'sod-bound' condition, which is widespread in brome grass fields in the State, involving pallor and weak growth, do not support Benedict's view (*J. Amer. Soc. Agron.*, xxxiii, pp. 1108–1109, 1941) that a toxin secreted by the growing or decomposing roots of the grass is responsible, but rather point to a deficiency of nitrogen as the determining factor. The application of ammonium sulphate at the rate of 200 lb. per acre more than overcame any detrimental effect exerted by the previous stand of brome grass, either by destroying or neutralizing any such toxin or by conferring on the plants the capacity to resist it. In a greenhouse test in which lucerne was grown alternately with brome and other grasses on (*a*) four-year-old 'sod-bound' brome grass soil, (*b*) two-year-old brome grass soil (not obviously 'sod-bound'), and (*c*) cultivated soil not previously used for brome grass, damping-off was prevalent among the lucerne seedlings (which overran the grasses and prevented their proper development) except in the 'sod-bound' flat, suggesting a change in the microbial flora of the soil due to the growth of the brome grass.

MOORE (M. H.) & ROGERS (W. S.). **Sun scald of fruits.**—*Gdnrs' Chron.*, Ser. 3, cxii, 2914, pp. 166–167, 1 fig., 1942.

During the first week of September, 1942, peaches, apples, and tomatoes growing at East Malling, Kent, developed severe sun scald. Injury followed a period at the end of August marked by high temperatures (maximum 84°, 86°, and 82° F. on 27th, 28th, and 29th, respectively), and long periods of sunshine, with high relative humidity. All the injured fruits were directly exposed to the sun, without foliage protection.

Severely affected peaches showed a soft, round or oval, flattened, reddish-brown area, in some cases 2 in. or more in diameter, surrounded by a narrow area of exposed flesh. Wasps, bees, and *Sclerotinia fructigena* completed the destruction of the fruits.

Many apples were similarly affected, but without skin rupture. On Newton Wonder, Bramley's Seedling, and Lane's Prince Albert the brown area was frequently surrounded by a narrow halo of pale green or greenish-yellow, immediately outside which was another, mixed halo of red or orange-red with a sharply defined inner edge, the outer edge shading off into the normal colour of the fruit. Almost all the severely affected fruits that remained on the trees finally became infected with brown rot (*S. fructigena*). On Allington Pippin the scald area was suffused, often very sunken, variable in colour, though generally dark or purplish-red, and typically forming an arc, but sometimes extending all round the apple and enclosing a healthy area. Worcester Pearmain apples showed only a slightly sunken area of intensified deep red. When severely injured, all varieties showed brown discoloration of the flesh beneath the affected area, and in many cases the sun scald was accompanied by water core [*R.A.M.*, xix, p. 353].

Affected Conference and Beurré Superfin pears were also observed, the abnormality in this case being a predominantly orange discoloration. On outdoor tomatoes the affected areas resembled those on certain apples, except that the high colour contrasts

were much less pronounced. The tomatoes became affected before they were ripe; the damaged areas were irregular, yellowish, and slightly sunken, forming saucer-like, hard, dry, corrugated depressions.

It is suggested that in small gardens it might be practicable to shade the fruit (especially peaches on walls) during very hot sunshine with muslin.

PLANK (R.). **Zur Theorie der Kaltlagerkrankheiten von Früchten.** [A contribution to the theory of the cold storage diseases of fruits.]—*Planta*, xxxii, pp. 364–390, 1941. [Abs. in *Chem. Zbl.*, cxiii (ii), 8, p. 910, 1942.]

On the basis of copious statistical data, supplemented by the results of experimental work at the Karlsruhe Technical Institute, the writer has devised mathematical formulae whereby the reaction of fruits to cold storage diseases may be forecast.

NATTRASS (R. M.). **Notes on plant diseases, Apple mildew.**—*E. Afr. agric. J.*, viii, 2, pp. 101–102, 1 fig., 1942.

In this brief, popular note on apple mildew [? *Podosphaera leucotricha*: *R.A.M.*, xviii, p. 784] and its control, the author states that in the higher regions of Kenya the King of Tompkin's County variety is often severely affected.

CARPENTER (J. B.). **Moldy core of Apples in Wisconsin.**—*Phytopathology*, xxxii, 10, pp. 896–900, 1 graph, 1942.

The symptoms of mouldy core of apples, which is prevalent, though of minor economic importance, in the Dudley and Delicious varieties in Wisconsin, were found to agree with those described by Brien from New Zealand [*R.A.M.*, xvi, p. 688] and Harrison from Nova Scotia [ibid., xiv, p. 592], consisting essentially in the permeation and darkening of the endocarp walls and seeds, the occlusion of the core cavity by a grey mycelial weft (in advanced stages), and incipient core rot with the onset of maturity, accompanied in the two varieties under observation by a precocious development of the yellow ground colour. An *Alternaria* of the *A. tenuis* group was the predominant organism in the mouldy fruits in 1939, 1940 and 1941, other fungi present including species of *Coniothyrium*, *Fusarium*, and *Hormodendrum*. Frequently in the Delicious variety, and less commonly in the Dudley, a calycine sinus unites the central core chamber with the calyx tube, but in its absence the distal end of the core cavity was separated from the calyx tube only by a thin layer of tissue. Inasmuch as several species of fungi were present in the calyx basin on dead floral remnants, the *Alternaria* appears to possess remarkable facility for entering the core and establishing itself.

COOLEY (J. S.). **Factors affecting distribution and severity of black root rot of Apple trees.**—*J. agric. Res.*, lxv, 6, pp. 299–311, 1942.

Black root rot of apple, due to *Xylaria mali* [*R.A.M.*, xvii, p. 827], is stated to be known only in the United States, where it occurs from Pennsylvania to Georgia and westwards to Arkansas, causing the greatest losses in the central and southern parts of this range. Although the factors influencing the distribution of this disease are as yet unknown, there are reasons to believe that temperature and genetic differences in the parasite might be of importance generally, while locally incidence may also depend on various conditions predisposing the host to attack. The disease is mostly encountered in bearing orchards, young trees and replants being only occasionally affected.

In inoculation experiments begun in 1933 in Virginia and later continued in Maryland, inoculations with agar cultures of the parasite and with small chips of infected wood placed in contact with the roots of seedling apples were not successful, whereas inoculations with fairly large pieces of infected apple twigs gave good results. Wounding did not appear necessary for either natural or artificial infection. The optimum temperature for growth of the fungus in agar culture was about 25° C., although fair

growth occurred at 15°. Roots of stored apple seedlings were infected at 15·5°. The 27 different isolates of the fungus used for inoculating one-year-old seedlings exhibited wide variation in pathogenicity, infection after six weeks ranging from 0 to 100 per cent. and the average length of the lesion caused from 6·6 to 42·5 mm. When apple, pear, plum, cherry, and peach seedlings were inoculated with *X. mali*, only the apple was undoubtedly susceptible; pear and cherry developed small lesions, but these were healed over by the next year. Analysis of variance of data from resistance tests made over three or four successive years showed only slight significance for variety in the 19 own-rooted standard apple varieties tested, and no significance for variety in the 30 seedling clones and in the seedlings of nine named apple varieties. Statistical analysis of the infection data showed a significant correlation between infection and season with high temperature during the 49 days after inoculation. Longevity of the fungus in infected apple roots was found to vary. In some experiments the fungus died within a few months after the death of the host; in some natural infections, on the other hand, it survived the host by several years.

HILDEBRAND (E. M.). **Indexing Cherry yellows on Peach.**—*Phytopathology*, xxxii, 8, pp. 712–719, 2 figs., 1942.

The cherry yellows [*R.A.M.*, xxi, p. 442] virus was transmitted from diseased (mostly Montmorency) to healthy cherry trees with the development of definite yellow-leaf symptoms within about a year, and was further communicated by budding in the late summer from infected cherries to healthy Elberta peach seedlings, which contracted die-back and a stunted rosette condition during the next growing season. On the removal of the shoot above the bud from four-year-old Elbertas, about a week after budding, the stub died back several inches below the diseased bud within a month.

In the first indexing experiment, involving the insertion of diseased cherry buds between two rapidly growing shoots on cut-back second-year Elberta peach grafts, chlorotic ring-spot symptoms were manifested within a fortnight of budding, while ring spot and rosette developed in the course of a month on yearling peach seedlings indexed with cherry buds affected by yellows and cut back to one node above the diseased bud: the incubation period was reduced to about three weeks on small (18-in. tall) seedlings in four different tests.

This rapid indexing technique promises to advance the work on cherry yellows, and may, with some modifications, prove generally applicable to studies on other stone-fruit viruses.

TUCKER (C. M.). **Scald of Sweet Cherry nursery stock caused by Bacterium syringae.**—Abs. in *Proc. Mo. Acad. Sci.*, v, 4, pp. 91–92, 1940.

Bacterium [*Pseudomonas*] *syringae* was isolated from the 'scalded' leaves and stems of sweet cherry nursery stock in Missouri, and inoculated with positive results into the same host, lilac, and other plants subject to infection by the organism. Under natural conditions (particularly in poorly drained soils) the leaves are attacked at a very early age, the spots then formed being small, circular, and light brown, with a reddish halo. As the leaves expand, the necrotic tissues drop out, leaving irregular holes. Stem infections occur near the growing tips, and are characterized by long, narrow streaks, water-soaked at first, later turning light brown to nearly black, while a copious flow of colourless or pale amber gum is exuded through the ruptured cortex. Marked curvature and deformation of the stem results from the arrest of growth on the invaded side. The leaf axils may also be attacked, in which case small, brown cankers are formed on the stems; these may be girdled and killed, while the buds, and occasionally the subtended leaves, also die. With the advent of warm, dry weather, the extension of the cankers ceases, and the formation of callus under the blackened cortex finally leads to the sloughing-off of most of the dead tissue.

MAIER (W.). **Ausmass, Ursache und Verhütung der Monilia-Fäule bei Aprikosen.** [Extent, cause, and prevention of the *Monilia* rot of Apricots.]—*Angew. Bot.*, xxiv, 3–4, pp. 303–321, 4 figs., 2 graphs, 1942.

Pursuing his studies in the Rhine Province on the apricot rot caused by *Monilia* [*Sclerotinia*] *fructigena* and *M. cinerea* [*S. laxa*: *R.A.M.*, xxi, p. 460], the author cites some statistics indicating the scope of the disease in 1939 and 1941. In the former year the percentage of rotted fruits on five trees was 63·1; in the latter the incidence of infection on six ranged from 14·9 to 33·3 per cent., the number of affected apricots on eight severely diseased branches from 30 to 72 per cent., while every one of the 176 fruits on an unharvested tree on 20th August was uneatable. The examination of some 500 rotten apricots showed that in almost every instance (at least 98 per cent.) the pathogen had gained ingress either through an apical cleft or by way of unilateral fissures. During August, 1941, 3,465 out of 7,290 apricots inspected (47·5 per cent.) were found to be attacked, almost exclusively through these channels, the incidence of invasion (0·5 per cent.) through a crack in the middle of the groove transecting the fruits being negligible for practical purposes. Only in 1·3 per cent. of the total did a single fruit show both apical and lateral injuries.

Of 29 varieties investigated, 17 showed over 50 per cent. injury, the most susceptible being Red Muscadine, Souvenir of Möhrlein, St. Jean, Royal, Redcheeked Early, Werder, Nancy, Triumph of Treves, Beauge, Pineapple, Syrian, Erfurt Early, Pineapple, Della Bella, Souvenir of Breda, Boulbon Early, and Large Fruit, with 69·9, 69·2, 67·9, 63·1, 60·2, 61·3, 60·1, 60·1, 60, 56·2, 56·2, 54·2, 54·1, 51·4, 50·7, and 50·7 per cent., respectively, and the most resistant Souvenir of Robertsau, Camper Sour, Holubs Sugar, and Uhlhorns Wonder, the corresponding figures for which were only 18·6, 8·1, 15·1, and 7·4 per cent., respectively. In 11 varieties less than 10 per cent. of the fruits developed apical clefts, and in 11 a maximum of 10 per cent. showed lateral fissures, three varieties, viz., Camper Sour, Holubs Sugar, and Uhlhorns Wonder, being common to both groups. Generally speaking, a high incidence of clefts connotes few cracks and vice versa. The frequency of cleft wounds decreased during the August ripening period, while the number of fissures increased.

The relation of meteorological factors to the injuries under observation is discussed, and the possibility that persistent humidity and a change from dry to wet weather are responsible for the formation of cracks and clefts, respectively, is envisaged. It is not improbable, however, that varietal idiosyncrasies are also concerned in the reaction of the fruits to these influences at a critical period in their development, Jony, Uhlhorns Wonder, and R1, B2, for instance, being resistant to apical cleavage, and Camper Sour, Moorpark, and Uhlhorns Wonder to lateral cracking.

The best hope of control would appear to lie in the breeding of resistant varieties (in which connexion attention is drawn to the importance of the fruit rot in paving the way for the even more serious die-back of the branches involving the destruction of the entire tree) already described [loc. cit.]. Supplementary cultural precautions should be directed towards methods of cultivation and pruning calculated to counteract excessive soil and atmospheric humidity, but little is to be expected from the application of these practices in the absence of a systematic breeding programme.

Proprietary products for the control of plant pests and diseases.—*Gdnrs' Chron.*, Ser. 3, cxii, 2915, p. 171, 1942.

With the concurrence of the Agricultural Improvement Council, a scheme by which official approval can be extended to proprietary fungicides and insecticides has been agreed upon by the Agricultural Departments in Great Britain and the Association of British Insecticide Manufacturers, and a Committee under the chairmanship

of Professor J. W. Munro has been appointed by the Minister of Agriculture and the Secretary of State for Scotland in consultation with the Agricultural Research Council to advise on applications made by manufacturers for the approval of their products.

The principles and conditions of approval are to be drawn up by a joint panel composed of the members of the above-mentioned Committee, together with four representatives of the Association of British Insecticide Manufacturers, a representative of the Government Chemist, and a representative of the Agricultural Research Council.

Further details may be obtained from the Secretary of the Committee, Plant Pathological Laboratory, Ministry of Agriculture, Milton Road, Harpenden, Hertfordshire.

DIMOND (A. E.), HORSFALL (J. G.), HEUBERGER (J. W.), & STODDARD (E. M.). **Role of the dosage-response curve in the evolution of fungicides.**—*Bull. Conn. agric. Exp. Sta.* 451, pp. 631–667, 16 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, pp. 230–231, 1942.]

The laboratory testing of fungicides provides a design which might well be more closely followed in field experiments. Under the former conditions a fungicide is tested at a number of dosages, data being secured on the extent of spore inhibition by each [*R.A.M.*, xxi, p. 424]. Plotting of these data on a logarithmic probability grid usually yields straight lines, but there are two noteworthy exceptions to this rule, in one of which the dosage-response curve consists of two or more linear segments, the whole curve constituting a broken line [ibid., xx, p. 543], while in the other, discussed in the present study, the curves exhibit peaks of toxic action. Both anomalies are explicable by the assumption that the toxicant dissociates (or associates) in water, and that the toxicity of the dissociated molecule differs from that of the undissociated. Fundamental properties of fungicides derivable from the linear type of dosage-response curve are the LD-95 or LD-50 (i.e., the lethal dosage for 95 or 50 per cent. of the treated spores), and the slope of the dosage-response curve, the latter meriting inclusion in the methods of fungicidal evaluation. LD-95 values depend on the fungicide, the species of fungus, age of culture, and spore load, as well as on the slope itself; slope may be affected by the test organism and is increased by any environmental factor contributing to the well-being of the latter. With all other factors constant, slope is likewise a property of the fungicide.

The slope of the dosage-response curve further gives an indication of the significance of tenacity. Generally speaking, fungicidal preparations presenting flat dosage-response (or dosage-control) curves need not have such high tenacity values as those with steep ones. Characteristics of an effective fungicide include low LD-95 and LD-50, flat dosage-control and dosage-response curves, or (if these be steep) high tenacity. The assumption of a correlation between laboratory and field conditions for fungicidal trials is postulated and the supporting evidence discussed. The efficacy of fungicidal action is shown to be markedly improved by more thorough coverage of the plant. The inconsistent results frequently obtained with two fungicides in repeated comparative tests, one material giving better performance in some cases than in others, is explicable on the hypothesis that the reversal effect is due to the crossing-over of dosage-control curves and to the differential shift in slope of the latter with modifications in the environment. The suggestion is made that in field experiments fungicides may be more quantitatively compared by measuring the dosage of each required to produce the same level of disease control, rather than by the calculation of the disease control levels secured by the application of single fungicidal dosages. This method involves the application of each fungicide in a dosage series.

Banerjee (S.). **Fusarium equiseti (Cda.) Sacc. (=Fusarium falcatum App. et Wr.) causing a leaf-spot disease of Eichhornia crassipes Solms. Part I.**—*J. Dep. Sci. Calcutta Univ.*, N.S., i, 3, pp. 29–37, 1 pl., 35 figs., 1942.

The species of *Fusarium* isolated from the diseased leaves of water hyacinth (*Eichhornia crassipes*) in a tank at the Calcutta University College of Science in 1930 was identified by H. W. Wollenweber as *F. equiseti*, pure cultures of which were grown on various standard media. The affected foliage bore yellowish to reddish, later dark to blackish-brown spots and streaks, coalescing to cover the entire leaf surface, both sides of which were involved. The infected areas gradually shrivel, but the resultant injury was only slight, the plants surviving for a considerable period with the emergence of adventitious leaves. Inoculation experiments on wounded and uninjured leaves were nearly all successful, but again the damage was unimportant and the progress of infection very slow owing to the high power of resistance of the host.

Ministry of Agriculture & Fisheries [of England and Wales]. Advisory Leaflets.

The following advisory leaflets have been amended: 204 (*Botrytis cinerea* causing gooseberry die-back); 253 (crown gall caused by *Bacterium tumefaciens*); 273 (*Sphaerotheca mors-uvae* on gooseberry); 277 (currant reversion); 279 (*Spondylocladium atrovirens* on potato); and 290 (potato spraing, internal rust spot, and net necrosis).

In Advisory Leaflet 38, which has been rewritten, a brief, popular account is given of the symptoms, sources of infection, prevention, and control of tomato mosaic [*R.A.M.*, xx, p. 607], together with short notes on tomato streak [ibid., xx, p. 430] and mixed-virus streak [loc. cit.].

To prevent mosaic, tomato seed should be taken from soft, ripe, unblemished fruit grown on vigorous plants free from mosaic mottling. The soil should be as free as possible from tomato debris, and should be sterilized. Even growth must be maintained throughout the life of the plants. Workers should not smoke while handling the plants and should wash their hands after pruning in each house.

Severe streak is most likely to appear when tomatoes grown under conditions of high temperature and excessive moisture suffer from potash deficiency or sudden drought. Sulphate of potash may in such cases be advantageously applied to induce a more balanced growth, followed by a balanced top-dressing.

Attack by mixed virus streak may be avoided by not growing tomatoes near potatoes and removing any volunteer potatoes found.

Greathouse (G. A.), Klemme (Dorothea A.), & Barker (H. D.). **Determining the deterioration of cellulose caused by fungi. Improvements in methods.**—*Industr. Engng Chem.*, Analyt. Ed., xiv, 8, pp. 614–620, 2 figs., 7 graphs, 1942.

At the Bureau of Home Economics, Department of Agriculture, Washington, D.C., the authors developed a standardized quantitative method for the estimation of fungal decomposition of cellulose [*R.A.M.*, xxi, p. 534], the material selected for the experimental work being bleached, degreased, 8-oz. Army cotton duck, cut into strips and cultured on a liquid medium, the formula for which is given.

Metarrhizium sp. and *Chaetomium globosum* were found to cause very rapid decomposition of the material, the loss in breaking strength of the fabric after seven days through the action of these fungi being estimated at 94·9 and 81·5 per cent., respectively. As test organisms for the purpose in view they are superior to *C. elatum*, *Alternaria* sp., *Cladosporium* sp., and *Stachybotrys papyrogena*. The hydrogen-ion concentration of the substratum appears to exert a strong influence on the activity of the cellulose-destroying fungi, all of which, except *Chaetomium globosum*, caused a greater loss in breaking strength at P_H 7 or less.

SMITH (G.). **An introduction to industrial mycology.**—Second edition. xii+260 pp., 136 figs., London, Edward Arnold & Co., Ltd., 1942. 20*s*.

The second edition of this useful text-book on industrial mycology [*R.A.M.*, xvii, p. 829] provides, in addition to some minor alterations and additions, a new key to the Hyphomycetales and includes a number of new illustrations.

CROWELL (I. H.) & LAVALEE (E.). **Check list of diseases of economic plants in Canada.**—68 pp., Dominion Department of Agriculture, 1942. [Mimeographed.]

This check list is a compilation of data on diseases of economic plants in Canada which have been accumulating for many years in the literature of the subject and in the notes and records of Canadian workers. The information given is arranged alphabetically under the Latin names of the hosts, and the causal organisms are similarly listed under each host. English and French common names of the hosts and their diseases are given and the distribution of each disease in Canada is briefly indicated.

In the introduction (given in English and French) the authors state that in compiling the list they have observed the following practices. The names 'root rot', 'stem rot', and 'basal rot' are applied to diseases whose causal organisms are known to be confined to the root, stem, and base (including the lower part of the stem and roots), respectively. Other names, such as crown rot, collar rot, and foot rot are not employed except in special cases. To obtain the common name of a disease the genus name of the causal organism is prefixed to the name indicating the type of disease; and the genus name, so used, is employed as an adjective and spelt with a small letter, e.g., 'alternaria leaf spot'. These rules do not, of course, apply to established names. The List of Common Names of British Plant Diseases has been used as a model throughout. A supplement dealing with the diseases of forest trees is in course of preparation.

HAYES (H. K.) & IMMER (F. R.). **Methods of plant breeding.**—xii+432 pp., 24 figs., 5 diags., 8 graphs, New York & London, McGraw Hill Book Company, Inc., 1942. £1. 8*s*.

The purpose of this valuable book 'is to summarize the methods of plant breeding that have been developed for particular categories of crop plants, to explain the reason why particular methods are chosen for certain types of crop-improvement problems, and to give methods of field-plot technique and of statistical analysis that are adapted for particular uses'. Every aspect of the principles and techniques involved, including those relevant to the problems of breeding for resistance to disease, receives adequate attention. Among others the following important diseases are dealt with: stem rust of cereals (*Puccinia graminis*), leaf rust of wheat (*P. triticina*) and crown rust of oats (*P. coronata*), wheat bunt (*Tilletia tritici*) [*T. caries*], loose and covered smuts of oats (*Ustilago avenae* and *U. levis* [*U. kolleri*]), covered and intermediate smuts of barley (*U. hordei* and *U. medians*), wheat and barley fusarial head blight or scab [*Gibberella zeae*], maize smut (*Ustilago zeae*), loose and covered smuts of sorghum (*Sphacelotheca cruenta* and *S. sorghi*), head smut of sorghum and maize (*Sorosporium reilianum*), flax rust and wilt (*Melampsora lini* and *Fusarium lini*), and (with special emphasis on back-crossing) cantaloupe powdery mildew (*Erysiphe cichoracearum*) and snapdragon [*Antirrhinum majus*] rust (*P. antirrhini*). The chapter dealing with seed production defines the objects of potato seed certification (now practised in 22 States of the American Union), and gives the disease tolerances allowed (in Maine).

THIRUMALACHAR (M. J.). **Olpidium uredinis parasitic within the urediospores of Hemileia canthii Berk. & Broome.**—*Curr. Sci.*, xi, 9, pp. 363–364, 3 figs., 1942.

Numerous uredospores of *Hemileia canthii* collected in Mysore State were hyperparasitized by *Olpidium uredinis*, which destroyed the cell contents and prevented

germination. A single uredospore of the rust contained up to nine hyaline, ovate or spherical sporangia of *O. uredinis*. Division of the sporangial contents into zoospores was observed, and in one case the formation of the exit tube traversing the uredospore wall was detected. The hypnospore may be distinguished from the sporangium by its thick wall, the exospore being smooth and hyaline.

YARWOOD (C. E.) & HAZEN (W. E.). **Vertical orientation of powdery mildew conidia during fall.**—*Science*, N.S., xcvi, 2492, pp. 316–317, 1942.

The authors' observations of the ellipsoidal spores of *Erysiphe graminis* and *E. polygoni* falling through the air in a glass tube showed that approximately equal numbers fell in the horizontal and vertical positions. This result appears to disagree with the principle stated by A. H. R. Buller (Researches on Fungi, II, p. 35, 1922) that the tendency is for elongated spores to assume the horizontal position during their fall.

FRAMPTON (V. L.), LINN (M. B.), & HANSING (E. D.). **The spread of virus diseases of the yellows type under field conditions.**—*Phytopathology*, xxxii, 9, pp. 798–808, 1 fig., 1 diag., 4 graphs, 1942.

In this paper a differential equation is developed to describe the spread of virus diseases of the yellows type under field conditions on the assumption that the movement of the insects involved is random, that the number of plants infected is proportional to the number of plants that have been fed upon, and that spread from plant to plant within the field is of small importance. Data obtained from experiments on potato yellow dwarf and on endive infected by aster yellows virus under conditions such that the insect population of the newly ploughed field was negligible, that the insect reservoir was not substantially depleted during the course of the experiment, and that the effects at the ends of the fields were neglected, satisfied demands made by the integrated form of the equation.

PORTER (J. N.). **The mycorrhiza of Zeuxine strateumatica.**—*Mycologia*, xxxiv, 4, pp. 380–390, 6 figs., 1942.

The orchid *Zeuxine strateumatica*, a native of south-eastern Asia, was first reported in Florida in January, 1936, and by June, 1938, was spreading rapidly throughout the peninsula. A radially growing fungus uniformly isolated from the roots and rhizomes was identified as *Rhizoctonia mucoroides*, the individual cells of the chains of conidia averaging 21 by 15 μ and the hyphae 6·4 μ in diameter.

Seeds of *Z. strateumatica* sown on cultures of the fungus growing on a slightly modified Burgeff's 'Sb' medium germinated in six to eight months from the time of sowing, better germination taking place in diffuse light than in the dark, whereas no germination occurred with seeds sown without the fungus on Knudson's medium.

The investigation is considered to offer clear indication that *R. mucoroides* is the endotrophic fungal symbiont associated with *Z. strateumatica* in Florida, though the fungus has not, apparently, previously been recorded there. The fact that it has now been isolated from *Zeuxine* spp. in both Java and Florida supports the view that there is a very close and specific relationship between orchids and their endotrophic symbionts. Since the orchid develops very rapidly it is suggested that it may prove a satisfactory subject for experimentation on orchid mycorrhiza.

THOMPSON (J. K.). **Potatoes—an experiment on the control of blight (Phytophthora infestans).**—*Kirton agric. J., 1939*, 3, pp. 7–28, 2 figs., 1939.

A detailed account is given of the results obtained at Kirton, Lincolnshire, from 1936 to 1938 in the control of potato blight (*Phytophthora infestans*) by dusting with copper fungicides.

The results from a series of trials to test the efficiency of copper-lime dusts

containing 10, 15, 20, and 24 per cent. metallic copper showed that the use of dusts containing as little as 10 per cent. copper is inadvisable however fine the dust, while the dust containing 24 per cent. copper depressed the yield in one season although it gave the most effective blight control. The keeping of the foliage covered with fungicide at all critical periods is of much importance.

In a second series of trials with copper sulphate and calcium carbonate or hydrate dusts prepared by different methods there were no significant differences between the effects of the different dusts, but the significant results obtained from treatment against no treatment emphasised the value of dusting.

Goss (R. W.) & Jensen (J. H.). **Susceptibility of Solanum species to Fusarium solani var. eumartii.**—*Phytopathology*, xxxii, 10, p. 913, 1942.

In tests at the Nebraska Agricultural Experiment Station of the tuber-bearing species of *Solanum* supplied by D. Reddick for their reaction to *Fusarium solani* var. *eumartii*, the following proved susceptible: *S. acaule*, *S. demissum* (Reddick 178, 418, and 519), *S. chacolense*, *S. commersonii* ('Blanca' and 'Colorado' from the Argentine), a species from Chili (P. I. 129381), and *S. antipoviczii*.

Krantz (F. A.) & Lana (E. P.). **Incidence of hollow heart in Potatoes as influenced by removal of foliage and shading.**—*Amer. Potato J.*, xix, 7, pp. 144–149, 1942.

The removal of 50 to 80 per cent. of the foliage at successive stages in the development of Irish Cobbler potato plants at the North Central branch (Grand Rapids) of the Minnesota Agricultural Experiment Station in 1940 and 1941 caused a decrease in the number of hills free from hollow heart [*R.A.M.*, xxi, p. 537] when carried out at tuber-setting time (9th July), but not at later stages. Shading the plants with black sateen cloth for intervals of five or ten days tended to increase the number of hills free from hollow heart when carried out at tuber-setting time, but had no effect later on. The incidence of the disease was approximately equal in hills harvested at an average hill weight of 157 gm. and an average tuber weight of 7·5 gm., and at maturity, when the corresponding figures were 776 and 53 gm., respectively. The removal of 20 to 80 per cent. of the foliage did not significantly influence the average number of tubers set per hill, the mean yield per hill, or the mean weight of the individual tubers. It is suggested that the active renewal of vegetative growth following the removal of the foliage in the early period of tuber enlargement may have been responsible for a temporary nutritional deficiency inaugurating the hollow-heart condition.

Clinch (Phyllis E. M.). **The identity of the top-necrosis virus in Up-to-Date Potato.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxiii, pp. 18–34, 1 pl., 1942.

In further studies at Glasnevin on the top-necrosis virus from Up-to-Date potatoes (= 'streak' virus, virus B, *Solanum* virus 4) [*R.A.M.*, xxi, p. 265], the author found that of 39 potato varieties tested, the majority reacted with top necrosis when grafted with scions from Up-to-Date potatoes carrying streak. All the others showed a transient mottle resembling that in Up-to-Date, except Irish Chieftain, which carries virus A, and reacted with crinkle (X+A).

Sap inoculation of the streak virus from Up-to-Date to healthy potato plants belonging to intolerant varieties gave rise to local necrotic lesions and on rare occasions to systematic necrosis. The virus was readily transmitted to tolerant varieties. Sap inoculation from Up-to-Date potatoes to *Datura stramonium*, tobacco, tomato, and *Lamium hybridum* gave mild mosaic symptoms of the virus X type, the presence of the streak virus being demonstrated by return grafts to potato.

The X-immune Seedling 41956 resisted infection with any virus from Up-to-Date and with virus X, but it was readily infected with potato viruses Y, A, stipple streak, F, and top-necrosis strain of F. Dykstra's claim that B could infect 41956 [ibid., xv, p. 310] could not be substantiated [cf. also ibid., xviii, p. 410]. When 41956 was

inserted as an intermediate scion between Up-to-Date and a susceptible basal stock in double-grafted plants, the virus content of Up-to-Date passed unchanged into the basal stocks. In similar double grafts where the Up-to-Date top scion was replaced by X-infected President, no resistance was shown by the intermediate 41956 scion to the downward passage of X. The 41956 scions did not become infected with X, or with any virus from Up-to-Date.

The removal of X from Up-to-Date sap by precipitation with anti-X rabbit serum resulted in the simultaneous removal of the virus responsible for streak.

The physical properties of the Up-to-Date streak virus resembled those described for viruses of the X type. The streak virus could not be introduced by sap inoculation to potato or *D. stramonium* plants already infected with X, but this immunity of X-infected plants to streak or other strains of X no longer obtained when the second virus was introduced by grafting.

When inoculated with sap from Up-to-Date plants affected with streak, healthy potatoes of intolerant varieties occasionally showed systemic infection with a non-necrotic X virus, though similar plants inoculated with a mixture of streak sap and X-infected sap all developed systemic X infection. It is suggested that the non-necrotic X virus may be a variant of the Up-to-Date streak virus in the local lesions.

It is concluded that the streak virus in Up-to-Date is a strain of X, differing from typical X only in its effects on certain potato varieties. The existence of a non-necrotic strain of X in conjunction with the top-necrosis strain in Up-to-Date has not yet been proved. The reason why virus X is unable to multiply in seedling 41956 is unknown, but it may be that some factor essential for its synthesis is lacking in this seedling. Evidence is presented of a correlation between movement of the Up-to-Date virus and food translocation.

Ryker (T. C.) & Douglas (W. A.). **Rice disease investigations: root rot studies.**—*Rice J.*, xliv, 12, pp. 9–11, 1941. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 2, p. 232, 1942.]

In pot tests at the Louisiana Agricultural Experiment Station rice plants inoculated with *Pythium* sp. alone contracted only slight infection of the root system, whereas those into which the pathogen was introduced in company with the root maggot *Lissorhoptrus simplex* developed severe injury. Field observations indicated that both the fungus and the insect were associated with root rot, but that either alone might occur without inducing root symptoms, denoting the possible secondary role of environmental factors. Over a two-year period of investigation high soil temperatures and a low state of fertility were found to favour the root rot, while beneficial effects followed the application of fertilizers and the drainage of the fields.

Kuilman (L. W.). **Uitstoeling en bloei van de Rijstplant III. Vatbaarheid van de (op voedingsoplossing gekweekte) variëteit Oentoeng voor Piricularia oryzae Cav.** [Tillering and flowering of the Rice plant III. The susceptibility of the Oentoeng variety (grown in a nutrient solution) to *Piricularia oryzae* Cav.]—*Meded. alg. Proefst. Landb., Batavia*, 45, pp. 27–32, 1 fig., 1940. [English summary.]

It was observed in nutrient solution cultures of the Oentoeng rice variety at the Agricultural Experiment Station, Buitenzorg, Java, that virulent attacks of blast (*Piricularia oryzae*) coincided with the close of the first period in the development of the plant, when tillering is interrupted by the elongation of the stems, which begins at about the age of 55 days. The pathogen destroyed the plants about a week after the onset of the outbreak, completely preventing growth in height but not in breadth. In one plant, which succumbed some days later than the rest, a certain amount of internodal elongation took place, thereby clearly demonstrating the responsibility of *P. oryzae* for the stunted condition.

Timonin (M. I.). **The interaction of higher plants and soil microorganisms: III. Effect of by-products of plant growth on activity of fungi and Actinomycetes.**—*Soil Sci.*, lii, 5, pp. 395–408, 3 pl., 1941.

This third contribution to the present series of papers [*R.A.M.*, xx, p. 29; xxi, p. 256] describes comparative studies of the rhizosphere of Bison and Novelty flax, resistant and susceptible, respectively, to *Fusarium lini*, which demonstrated that the incidence of *Alternaria tenuis* (group), *Cephalosporium humicola*, *Fusarium bulbigenum*, *F. culmorum*, *F. oxysporum*, *F. solani* var. *martii*, *Helminthosporium sativum*, and *Verticillium chlamydosporium* was relatively reduced, and that of *Mucor hiemalis*, *M. racemosus*, *Cladosporium herbarum*, *Penicillium chrysogenum*, *P. intricatum*, *P. janthinellum*, *P. lilacinum*, *P. restrictum*, *P. terrestre*, *Trichoderma viride*, and *T. album* increased by the rhizosphere effect of the resistant as compared with the susceptible variety.

When the solutions in which plants had been grown were allowed to diffuse through collodion membranes into the soil, the microbial activities in the vicinity of the membrane were stimulated in a manner analogous to that in the natural rhizosphere of corresponding plants. The solution after growth of the susceptible variety, when added to liquid or solid media, caused greater stimulation of growth in *F. culmorum* and *H. sativum* than did the solution after growth of the resistant variety. With *T. viride*, however, the solution after growth of the resistant variety exerted greater stimulation. The solutions after growth of the resistant variety contained 25 to 37 mg. hydrocyanic acid per plant grown as against only a trace in the case of the susceptible. Potassium cyanide, added to Crone's solution (8·2 mg. per 100 ml.), produced an effect on the growth of these fungi similar to that given by the solution after growth of the resistant variety.

The work shows that different fungi make a different response to minute quantities of hydrocyanic acid; since the resistant variety excretes this substance into the surrounding medium, it exercises a selective effect on the fungal flora of the rhizosphere. *T. viride* is of special interest in this respect, because it tolerates small amounts of the acid better than some pathogens, and is considered by some workers to control the activity of pathogenic fungi in the soil [ibid., xx, pp. 108, 492, *et passim*].

Yarwood (C. E.). **Fungicide treatment of string supports for control of Hop downy mildew.**—Abs. in *Phytopathology*, xxxii, 9, p. 830, 1942.

Following up Magie's observations (*Phytopathology*, xxx, p. 16, 1940) as to the protective effect of the drip from Bordeaux-sprayed hops on the untreated growth, experiments were carried out in six gardens in California in 1942 to determine the practicability of impregnating the string supports with an appropriate fungicide in such a way that splashing and dripping rain would convey the disinfectant to the spores of *Pseudoperonospora humuli* on the nodes and growing points, the principal sites of infection under local conditions. The natural drip during rain from cotton strings treated with low-lime Bordeaux (7·5 per cent. copper sulphate plus 2·5 per cent. lime), diluted to $\frac{1}{20}$ its field strength, prevented the germination of the sporangia of the pathogen in watch glasses, and vines growing on strings disinfected with this compound bore 80 per cent. fewer leaf and 50 per cent. fewer nodal infections, and 78 per cent. fewer diseased basal shoots than those on untreated strings in one garden.

Report on the British West Indies Central Sugar-Cane Breeding Station for the year ending September 30th, 1941.—37 pp., [? 1942].

In this report it is stated that sugar-cane mosaic is to be found everywhere in Jamaica. At Hope Gardens it is so virulent that even reputedly resistant varieties, such as P.O.J.2878, are comparatively susceptible, while only eight miles away, at Cow Park nursery, both the incidence and the effects of the disease are only slight.

At least three strains of the disease appear to be present in Jamaica [*R.A.M.*, xx, p. 226], differing in their distribution, symptoms, and the varieties they attack. It is clear that variety resistance tests carried out in Barbados must have small validity in Jamaica, and that the mosaic reactions of varieties sent to Jamaica will have to be tested in the island itself, such reactions being determined separately for the different areas.

The B.3439 seedling has given very promising results and in certain localities is being planted commercially. Though noble, it is highly resistant to mosaic; in four plant cane tests in 1940 it gave appreciably more sugar per acre than B.H.10 (12). B.34104 makes remarkable growth as a plant and a ratoon, but is extremely susceptible to mosaic; it is, however, very tolerant of the disease, and many estates intend to plant it on a commercial scale.

Evans (H.). **An investigation of physiological methods of determining nutrient deficiencies in Sugar Cane.**—*Ann. Bot., Lond.*, N.S., vi, 23, pp. 413–436, 5 figs., 4 graphs, 1942.

A full account is given of investigations carried out in Mauritius into the diagnosis of mineral deficiencies in sugar-cane. Leaves taken from plants grown in plots deficient in nitrogen, phosphate, or potash failed to respond to injections with 0·05 per cent. urea, 0·05 per cent. sodium dihydrogen phosphate, or 0·05 per cent. potassium sulphate, respectively. Stem injections similarly led to no increase in growth rate. Injection methods therefore do not appear to hold out much promise for the diagnosis of nutrient deficiencies of sugar-cane. On the other hand, growth responses to different soil treatments of the crop actually growing in the area concerned were found to give accurate and reliable results within two months.

Fitzpatrick (H. M.). **Revisionary studies in the Coryneliaceae.**—*Mycologia*, xxxiv, 4, pp. 464–488, 43 figs., 1942.

This paper, together with a second part expected to appear later, constitutes a revision of the writer's earlier monograph on the same group (*Mycologia*, xii, pp. 206–267, 49 figs., 1920). Descriptions, with diagnoses, are given of the seven species retained in *Corynelia*, of two species of *Tripospora* (one new), of the new genus *Coryneliospora*, its type species *C. tripos*, and *C. fructicola* n. comb., and of *Lagenulopsis* n. gen. and its type species, *L. bispora* n. comb. (syn. *Corynelia bispora* Fitz.). Keys are given to the species of *Corynelia* and *Tripospora*.

Ray (W. W.). **Notes on Oklahoma Cercosporae. II.**—*Mycologia*, xxxiv, 5, pp. 558–562, 1942.

This list of 20 species of *Cercospora* from Oklahoma includes four new to science, of which *C. corylina* on leaves of *Corylus rostrata* and *C. americana avellana*, is of special interest; the remaining 16 are recorded for the first time from this State.

Roberts (Catherine). **Morphological similarity in culture between Torulopsis pulcherrima and Taphrina deformans.**—Abs. in *Phytopathology*, xxxii, 9, p. 829, 1942.

Striking similarities were observed in three- to five-month-old cultures on potato dextrose and vegetable agars between *Torulopsis pulcherrima* and *Taphrina deformans* in respect of their cellular morphology. Two out of four isolates of *Torulopsis pulcherrima* produced globose, thick-walled cells occupied by single fat globules and with adhering remnants of cell walls. Other cells were furnished with single bud-like protrusions (interpreted by Windisch as asci [*R.A.M.*, xx, p. 382]). Similar globose, thick-walled cells with many fat globules and attached wall remnants were observed in the case of *Taphrina deformans*, as well as bud-like protrusions, some of which were

inhabited by one to three ellipsoid bodies (? ascospores). These analogies, together with such macroscopic cultural resemblances as dissociation into pigmented and non-pigmented areas, suggest a closer affinity between the two fungi under discussion than is indicated by their present taxonomic positions.

REID (J. J.), NAGHSKI (J.), FARRELL (M. A.), & HALEY (D. E.). **Bacterial leafspots of Pennsylvania Tobacco. I. Occurrence and nature of the microorganisms associated with wildfire.**—*Bull. Pa agric. Exp. Sta.* 422, 36 pp., 1942.

A full account is given of investigations carried out in Pennsylvania into the nature and identity of the organisms associated with leafspot diseases of tobacco, in the course of which 640 representative cultures (selected from 4,000 strains) of green-fluorescent Gram-negative bacteria from seed-bed soils and from plant material from seed-beds and fields were compared with known cultures [*R.A.M.*, xix, pp. 48, 679]. These 640 strains were divided into two groups, 27 monotrichous cultures conforming to the description of *Bacterium pyocyaneum*, and 613 lophotrichous strains, of which 603 were referable to *Bact.* [*Pseudomonas*] *fluorescens* and 10 to *Bact. putridum*. The group of 603 cultures of *P. fluorescens* included isolations from other laboratories as *Phytomonas tabaci* [*Pseudomonas tabaca*], *Phytomonas* [*Pseudomonas*] *angulata*, *Phytomonas primulae* [ibid., xvi, p. 256], *P.* [*Pseudomonas*] *cerasi*, *Phytomonas* [*Pseudomonas*] *vignae*, and *Phytomonas* [*Pseudomonas*] *syringae*. From serological studies on 25 representative cultures it is concluded that the organism associated with tobacco wildfire is antigenically identical with *P. fluorescens*, and that *P. angulata*, *Phytomonas primulae*, *Pseudomonas cerasi*, and, possibly, *P. vignae* and *P. syringae* are also identical with *P. fluorescens*.

Observations on the transformation of the capsular antigenicity of *P. fluorescens* on normal clover plants indicate that the antigenic specificity of the wildfire organism in the M phase is a reflection of capsular changes occurring during the reproduction of the organism as an innocuous epiphyte.

The results also demonstrate that the tobacco leaf spot organism is always present in soil and that *P. tabaca* is identical morphologically, culturally, and serologically with the common soil form, *P. fluorescens*. Hitherto it has been held that *P. tabaca* was a parasitic form that did not live independently of its host, but the complete reciprocal agglutinin absorption demonstrated in both the M and S phases between a virulent culture of *P. tabaca* and *P. fluorescens* leaves little, if any, doubt of the identity of the two forms.

As to how a normal soil bacterium such as *P. fluorescens* can suddenly become involved in such a rapidly spreading disease as wildfire, some factor may possibly arise which disturbs the balance between the tobacco plant and its normal bacterial flora, so leading to leaf spot.

The peculiar antigenic components characterizing the M phase of *P. tabaca* are enhanced by reproduction of the organism as a plant epiphyte, but it is not, therefore, to be concluded that such progressive changes in the nature of the organism conduce to sufficient virulence to overcome the resistance of a normal plant. The strain used (80) was isolated from a normal, healthy tobacco plant, which at no time showed any sign of disease, though other plants, growing under less favourable conditions in nearby plots, were severely affected. This strain was more virulent on a susceptible host than any strain obtained from other workers.

Seed-bed steaming does not eliminate the bacteria associated with leaf spot [loc. cit.], but rather results in an increase in their prevalence. Tobacco is produced as a rule in the presence of the leaf spot organisms, inasmuch as they were present in all seed beds examined and on most of the plant material. The disease is not due to the mere presence of these organisms, but to some other factor or factors.

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REVIEW
OF
APPLIED MYCOLOGY

VOL. XXII | MARCH | 1943

HILLS (C. H.) & MCKINNEY (H. H.). **The effect of mosaic virus infection on the protein content of susceptible and resistant strains of Tobacco.**—*Phytopathology*, xxxii, 10, pp. 857–866, 1942.

Infection by the tobacco mosaic virus was experimentally shown to cause a marked increase in the total nitrogen content of a susceptible variety, Wisconsin-Havana-Seed, grown under conditions of low, medium, and high nitrogen nutrition [cf. *R.A.M.*, xix, p. 169; xx, p. 499]. Infected plants of the resistant T.I.448 A variety receiving a reduced nitrogen supply showed a decrease in total nitrogen content, which was not apparent, however, in those more liberally supplied with nitrogen.

The chlorophyll content of mosaic-diseased foliage of Wisconsin-Havana-Seed tobacco was 30 per cent. lower than that of healthy leaves, the chlorophyllase activity in the former being also correspondingly reduced. No such changes were observed in the infected leaves of T.I.448 A. Both susceptible and resistant strains underwent a decrease of oxidase activity as a result of mosaic infection, the diminution in the latter being only slightly less than in the former, so that a very small amount of virus nucleoprotein evidently suffices to produce measurable alterations in the metabolism even of a resistant tobacco variety.

REYNARD (G. B.). **'Dunking' Tomatoes for their health.**—*Sth. Seedsm.*, v, 1, pp. 10, 30, 5 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 4, p. 539, 1942.]

Highly satisfactory results in the differentiation between tomato seedlings resistant or susceptible to grey leaf spot (*Stemphylium*) [*solani*] and early blight (*Alternaria*) [*solani*] have been obtained [in the United States] by dipping potted seedlings in a mixture of liquid cultures of the pathogens broken into fine particles by an electric stirrer [*R.A.M.*, xx, p. 546]. After two days in a moist chamber the plants are placed on a greenhouse bench for observation and the diseased ones easily eliminated. The method is also applicable in the field.

ALEXANDER (L. J.). **A new strain of the Tomato leaf mold fungus (Cladosporium fulvum).**—*Phytopathology*, xxxii, 10, pp. 901–904, 1 fig., 1942.

In this expanded account of his studies on the new strain of tomato leaf mould (*Cladosporium fulvum*) pathogenic to the normally resistant Globelle variety, a note on which has already appeared [*R.A.M.*, xix, p. 308], additional evidence is presented to show that the host range of the fungus is not restricted to the domestic species, all the 30 plants of Red Currant (*Lycopersicum pimpinellifolium*) inoculated with the Globelle strain contracting infection while remaining immune from attack by that from Globe. Sixteen plants of the ordinarily resistant Vetomold variety, immune from the Globe strain of *C. fulvum* [ibid., xxi, p. 172], succumbed to infection by the new one, as also did 15 of Bay State. The disease does not assume such a severe form on Globelle as on Globe.

The slight differences in the spore dimensions of the two strains, averaging 3·89 by 1·80 and 3·84 by 1·74 μ for Globelle and Globe, respectively, are not regarded as significant.

SAMSON (R. W.). **A study of certain viruses pathogenic to the Tomato.**—*Proc. Ind. Acad. Sci.*, xlix (*1939*), pp. 77–83, 4 figs., 1940.

Reviewing the literature on tomato streak the author states that the earliest reference to this disease is by C. B. Plowright (*Gdnrs' Chron.*, ii, p. 532, 1887) [who attributed streak symptoms to *Cladosporium fulvum*]. In Indiana winter blight or streak is considered to be a double virus infection in which the two viruses concerned (belonging to virus groups 'A' and 'B') are of the tobacco mosaic and the healthy potato virus [potato virus X] type, respectively [*R.A.M.*, xiv, p. 261], one strain of the latter, originally collected on *Datura stramonium*, being very virulent. The writer gives a full account of his experiments on the synthesis and analysis of mixed virus streak. Sometimes the complete streak complex was recovered from the non-necrotic parts of Black Beauty eggplants and Cayenne pepper (*Capsicum frutescens*).

SELMAN (I. W.). **The relation between mosaic infection and yield reduction in glasshouse Tomatoes.**—*J. Pomol.*, xx, 1–2, pp. 49–58, 2 graphs, 1942.

This is an expanded account of work already noticed from another source [*R.A.M.*, xxii, p. 9].

CROMWELL (B. T.) & HUNTER (J. G.). **Chlorosis in Tomatoes.**—*Nature, Lond.*, cl, 3812, pp. 606–607, 1942.

A chlorotic condition of tomato plants in the west of Scotland was investigated at the Agricultural College, Auchincruive, Ayr, and is tentatively attributed, on the basis of chemical analyses, to a deficiency of available magnesium, the content of which in the affected leaf blades amounted to only 0·10 per cent. dry matter as compared with 0·43 per cent. in normal foliage, probably aggravated by an unduly high concentration of potassium (0·1 to 0·3 per cent.) in the local soils. The particular type of chlorosis under observation, which was characterized by a bright yellow or greenish-yellow coloration of the interveinal areas, occasionally involving the margins, was commonly associated with the presence of root-rotting fungi, a poor physical condition of the soil, and low soil temperatures, all such factors tending to reduce the capacity of the plants to absorb an adequate quantity of magnesium.

RADEMACHER (B.). **Kupfermangelerscheinungen bei Forstgewächsen auf Heideböden.** [Copper deficiency manifestations among forest stands on moorland soils.]—*Mitt. Forstw. Forstwiss., 1940*, pp. 335–344, 7 figs., 1940. [Abs. in *Z. PflKrankh.*, lii, 7–8, p. 399, 1942.]

A three-year study has been carried out on the copper requirements of pine (*Pinus sylvestris*), spruce, larch, and birch in connexion with an extensive afforestation programme on the moorland soils of north-western Germany. Grown in pots of such soil, pines commenced in the first year to show deficiency symptoms comprising needle discoloration, stunting, and even dying-off in individual cases, a similar discoloration of the needles and weaker growth, accompanied by premature needle-shedding of the youngest shoots, being observed in spruce. In the second year the larches showed generalized stunting and an extraordinary creeping growth of certain shoots. In the case of the birches the admixture of copper with the soil failed to induce a favourable response, their development being retarded rather than advanced. As the amounts of copper available in the different soil layers vary, these results may not be applicable to field conditions without further testing. Evidence is adduced that the reaction

of different species to copper deficiency is hereditary, and it is thought probable that some hitherto inexplicable cases of 'dying-off' may be attributable to this cause.

Cooley (J. S.). **Defoliation of American Holly cuttings by Rhizoctonia.**—*Phytopathology*, xxxii, 10, pp. 905–909, 2 figs., 1942.

At the United States Bureau of Plant Industry Station, Beltsville, Maryland, American holly (*Ilex opaca*) cuttings were severely attacked in 1936 and 1937 by *Rhizoctonia* [*Corticium*] *solani*, the symptoms produced by which included a cobweb-like appearance of the under sides of the leaves due to the adherence of hyphae and enmeshed grains of sand from the rooting medium, followed in two or three weeks by defoliation and the production of black sclerotia on the fallen leaves, a zonate leaf spot (not consistently present), and blackening of the petioles and parts of the leaf blades. The fungus was grown in pure culture on potato dextrose agar, on which the optimum temperature for its development was between 25° and 30° C., the minimum and maximum being below 15° and over 30°, respectively. The differences between the holly isolate and a potato strain of *C. solani* were insignificant. Among the flowering plants sustaining more or less severe damage when grown in a bed infested with the holly pathogen were *Begonia* (Lorraine type), *Buddleia davidi*, *Chrysanthemum*, *Fuchsia*, *Pelargonium hortorum*, and *Antirrhinum majus*. None of the chemicals used for the disinfection of the cutting beds gave satisfactory control of the leaf blight, which was effectively combated, however, by thorough sanitation, involving the renewal of the beds with fresh clean sand after disinfection of the benches and the adoption of precautions against recontamination.

Christensen (C. M.) & Kaufert (F. H.). **A blue-staining fungus inhabiting the heartwood of certain species of conifers.**—*Phytopathology*, xxxii, 8, pp. 735–736, 1942.

Each of the 50-odd northern white cedar (*Thuja occidentalis*) trees dissected by the writers during the past few years in northern Minnesota revealed extensive blue stain in the heartwood, usually occurring in the form of streaks above and below branches or stubs. The dark, slow-growing, non-sporulating fungus mainly or exclusively responsible for the condition is evidently identical with that described by the second-named author as the agent of heart rot of balsam fir [*Abies balsamea*: *R.A.M.*, xvi, p. 77] and by Crowell as causing heart blue stain of the same host and white spruce in Canada [ibid., xix, p. 630]. In over 100 isolations the blue-staining fungus was constantly associated with other organisms, but pure cultures of the former were obtainable by cutting hyphal tips on hanging agar drops.

Sterilized pieces of white cedar heartwood inoculated with the fungus under observation slowly became covered and penetrated by the mycelium, the constricted hyphae of which traversed the cell walls of the tracheids and rays. Dissemination is readily effected by means of hyphal fragments.

The dark-coloured fungus, with its associated organisms, was obtained in some 20 per cent. of several hundred isolations from a brown cubical trunk rot originating at the branch stubs, and a brown, feathery butt and trunk rot starting in the roots of *T. occidentalis*, as well as from the branch stubs of *A. balsamea*, and is also believed to inhabit the heartwood of western red and Port Orford cedars [*T. plicata* and *Chamaecyparis lawsoniana*, respectively].

Verrall (A. F.). **A comparison of Diplodia natalensis from stained wood and other sources.**—*Phytopathology*, xxxii, 10, pp. 879–884, 1942.

To test the validity of his contention that the inoculum of *Diplodia natalensis*, the agent of a stain of timber and logs in Louisiana, is largely derived from other sources [*R.A.M.*, xix, p. 316], the author carried out comparative cultural studies on malt agar at room temperature and 37° C. of 16 isolates of the fungus from cotton bolls,

a tung [*Aleurites* sp.] root, a pear stem, an orange fruit, and pine, yellow poplar [*Liriodendron tulipifera*], *Magnolia*, and sweet gum [*Liquidambar styraciflua*] wood.

Although there were considerable variations at 37° among the various isolates in growth rate, spore dimensions, and gross macroscopic appearance, in none of their cultural characters did the wood strains differ appreciably from those from other hosts. Thirteen isolates tested on pine and sweet gum sapwood caused intensive staining, 14 produced rapid decay of oranges, and 11 caused black boll rot of cotton, but none of the ten inoculated into tung roots induced more than small temporary cankers.

On the basis of these studies the strain of *D. natalensis* responsible for the staining of wood is regarded as identical, at any rate for practical purposes, with the isolates from other hosts. Little fruiting of *D. natalensis* was observed on stained timber from which the fungus was isolated, and some of the inoculum inducing wood stain is probably derived from such plants as cotton.

Malm (M.). **The origin of slime formation in paper mills.**—*Svensk. PappTidn.*, xliv, 23, pp. 520–529; 24, pp. 554–557, 1941. [Swedish. Abs. in *Bull. Inst. Pap. Chem.*, xii, 9, pp. 297–298, 1942.]

Contradictory views having been expressed by previous investigators as to the fungal or bacterial origin of slime formation in paper mills, the writer attempted to identify the micro-organisms concerned in the development of this trouble at the Hallsta mill. Although it proved impracticable, either with pure cultures of the bacteria, yeasts, and fungi isolated from the slime and water of the mill, or with the material itself, to produce an artificial slime of the characteristic nature formed in the course of operations, certain types of fungi grew so rapidly in pure culture as to merit further study in this connexion, notably a species of *Cephalosporium*. Discoloration of the slime may be caused by *Cladosporium*, *Pullularia*, and other species of fungi.

Buse (R.). **Versuche über den Einfluss der Lagerungsart osmotierter Hölzer auf die Eindringtiefe des Imprägniersalzes in das Holz.** [Experiments on the influence of the mode of storage of osmotized timbers on the depth of penetration of the preservative salt into the wood.]—*Holz Roh- u. Werkstoff*, v, 5, pp. 156–160, 4 figs., 1942.

Following up the experiments of Liese and Schubert on the osmotic method of timber preservation [*R.A.M.*, xx, p. 505], the author carried out a series of tests in the summer of 1940 at the Zicher (Neumark, Germany) Forestry Station to determine the influence of the mode of storage on the depth of penetration of two preservatives, viz., thanalith U, consisting of 26, 12, 37, and 25 per cent., respectively, of sodium fluoride, dinitrophenol, sodium dichromate, and sodium arsenate, and osmolit UA, composed of 26, 35, 24, and 10 per cent., respectively, of sodium fluoride, potassium dichromate, sodium arsenate, and dinitrophenol, with an admixture of 5 per cent. glue, one part of each being mixed with an equal quantity of water and applied in the form of a paste at the rate of 4 kg. per cu. m. to pine and spruce poles 7 m. in length. These were then stored for four months (1) in a wind- and water-tight, triangular pile; (2) in the same way, but without protection from the weather; and (3) laid side by side.

By means of the zircon-alizarin test, applied to freshly cut sections of the treated poles, it was ascertained that the average depths of penetration of the salts into pine and spruce stacked under cover were 2·5 and 1·8 cm., respectively, the corresponding figures for those piled up but left unprotected and for the lot placed side by side being 1 and 0·9 and 0·7 and 0·7 cm., respectively. It is apparent from these data that thorough protection of impregnated timber is essential, both to prevent the leaching out of the disinfectant and to maintain the wood in a sufficiently moist condition for the diffusion of the salts.

Lindegren (R. M.). **Chlorinated phenols on the wood-protection front.**—*Sth. Lumberm.*, clxiii, 2057, pp. 219–222, 7 figs., 1941.

This is a review of the properties, uses, and various methods of application of the water- and oil-soluble chlorinated phenols for the control of wood-staining and -destroying fungi, among the recently developed commercial products belonging to the former group [in addition to those already referred to in this *Review*] being permatox 10 S, a mixture of chlorinated phenols and borated chemicals particularly suitable for small mills and concentration yards, while the latter category includes permasan and permatox A, adapted primarily for the large-scale preservation of timber by the pressure and soaking treatments.

The outlook for the extension of the use of the chlorinated phenols is briefly discussed. Such a step is deemed advisable in the non-pressure and clean-treatment fields, and is justifiable in the case of the pressure system where a clean, paintable, or non-bleeding treatment is indicated, but the wholesale substitution of this group of chemicals for the standard pressure methods of impregnation with creosote-petroleum or creosote-coal tar, is not thought to be warranted at the present juncture.

Dearborn (C. H.). **Boron nutrition of Cauliflower in relation to browning.**—*Bull. Cornell agric. Exp. Sta.* 778, 29 pp., 16 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 4, pp. 537–538, 1942.]

In the autumn of 1934 some 30 per cent. of the cauliflowers on 150 farms covering 443 acres in the Catskill Mountains were found to be unfit for marketing owing to browning of the heads, other symptoms of the disorder including a bitter flavour both in the raw and cooked state even in the absence of browning. The trouble was experimentally traced to boron deficiency [*R.A.M.*, xxi, p. 510] and was corrected by the use of borax, either mixed with the fertilizer and broadcast or applied in trenches near the rows. In a greenhouse test the fresh weight of treated whole plants exceeded that of the boron-deficient controls by 14·5 per cent., the corresponding increase for the heads alone being 44 per cent. The first manifestation of boron deficiency in the green plants occurred in the parenchyma cells of the pith and the stem cortex. Evidence from microchemical tests pointed to disorganization within the conducting system in an advanced stage of boron deficiency.

Owen (F. V.), Murphy (A. M.), & Tolman (B.). **Progress in breeding Sugar Beets for curly top resistance.**—Abs. in *Phytopathology*, xxxii, 9, pp. 828–829, 1942.

In many trials in the western United States high yields have been obtained from curly top-resistant sugar beets under conditions involving the total failure of European varieties [*R.A.M.*, xxi, p. 510]. U.S. No. 1, the commercial use of which dates from 1934–5, was soon replaced by Nos. 34, 33, and 12, of which, however, only the highly productive 33 will be extensively cultivated in the future. U.S. No. 22, now available to commercial growers, makes satisfactory growth under good cultural conditions even in the presence of curly top, some damage from which may result, however, if the plants are neglected or inadequately irrigated. A still higher degree of resistance to curly top is obviously desirable, but owing to the intensive self-sterility of U.S. No. 1 and all other resistant varieties so far produced, mass selection has hitherto constituted the chief means of improvement. Now, however, inbreeding experiments are facilitated by the existence of a number of self-fertile resistant lines.

Bennett (C. W.). **Longevity of curly top virus in dried tissue of Sugar Beet.**—Abs. in *Phytopathology*, xxxii, 9, pp. 826–827, 1942.

In July, 1934, small sugar beet plants suffering from curly top were dried at room temperature and divided into four lots, of which (1) was exposed to the humidity of laboratory air throughout the test period of eight years; (2) was placed over calcium chloride in an air-tight container; (3) was also placed over calcium chloride in a

container in which air was replaced by hydrogen during the first year and admitted for the remaining period of the test; and (4) was stored in a container with hydrogen for the first year and air thereafter. Twenty seedling beets were inoculated annually from each lot, except in 1940, the following numbers contracting infection in the successive years: (1) 3, 3, 11, 0, 0, 0, 0, and 0, respectively; (2) 2, 2, 8, 3, 7, 0, 2, and 0, respectively; (3) 5, 1, 18, 1, 2, 2, 3, and 2, respectively; and (4) 3, 0, 12, 0, 0, 0, 0, and 0, respectively. The activity of the virus is thus maintained under thoroughly dry conditions for a period of at least eight years.

LACKEY (C. F.). **Relative concentrations of two strains of curly top virus in tissues of susceptible and resistant Beans.**—*Phytopathology*, xxxii, 10, pp. 910–912, 1942.

In some of the writer's studies on the relationship of the curly-top virus to root-tips of beets at Riverside, California, it was necessary to supplement the root tips of this host by those of two bean (*Phaseolus vulgaris*) varieties, one fairly resistant (Great Northern U.I.81) [*R.A.M.*, xx, p. 43] and the other (Bountiful) highly susceptible to the disease. The two virus strains used were those designated by Giddings as 1 and 4 [ibid., xvii, p. 787], and after inoculation the cut root tips macerated in a 5 per cent. sucrose solution, were supplied to non-viruliferous leafhoppers, which were then caged singly on susceptible sugar beet seedlings. The tabulated results of the tests showed that in the resistant bean variety, the virulent virus 1 is promptly inactivated or its multiplication rapidly inhibited, whereas in highly resistant sugar beets, on the contrary, it was found to persist [loc. cit.]. In the root tips of the susceptible Bountiful, moreover, the virulent strain 1 quickly reaches a higher concentration than the less virulent 4 in contrast to the results with susceptible beets (author's unpublished data), in which the latter attains a slightly higher concentration than the former.

CARSNER (E.), PRICE (C.), & GILLESPIE (G. E.). **Effect of temperature on the epidemiology of Sugar-Beet downy mildew.**—Abs. in *Phytopathology*, xxxii, 9, p. 827, 1942.

Downy mildew [*Peronospora schachtii*] often assumes a severe form on sugar beets grown for sugar in the coastal districts of California [*R.A.M.*, xvii, p. 720] and on those raised for seed in the Willamette Valley of Oregon, and along Puget Sound, Washington, the epidemiology of the disease apparently depending mainly on temperature. Relatively low temperatures permit spore germination and the establishment of infection, but slightly higher ones are requisite for sporulation. At about 70° F. all development of the fungus is arrested [ibid., xvii, p. 366] and mildly damaged plants begin to recover.

LE CLERG (E. L.), PERSON (L. H.), & MEADOWS (S. B.). **Further studies on the temperature relations of sclerotial isolates of Rhizoctonia solani from Potatoes.**—*Phytopathology*, xxxii, 8, pp. 731–732, 1942.

In further studies at the Louisiana Agricultural Experiment Station on the temperature relations of sclerotial isolates of *Rhizoctonia* [*Corticium*] *solani* from potatoes [*R.A.M.*, xx, p. 391], 63 of these from various States were compared in pure culture on potato dextrose agar at 20°, 25°, and 30° C. with two crown-rot and two dry-rot canker strains from sugar beet. As in the previous series of investigations, the potato isolates made the maximum radial growth at 25° (average colony diameter of two ranging from 46·5 to 62·5 mm.), while those from sugar beet grew best at 30°.

ANDRÉN (F.). **Förberedande betningsförsök mot Ascochyta hos Ärter.** [Preliminary disinfection experiments against *Ascochyta* on Peas.].—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, v, 3, pp. 45–47, 1941.

The application to peas in greenhouse tests of uspulun dust at the prescribed

dosage of 2 gm. per kg. failed to control *Ascochyta pisi*, which yielded, however, to higher concentrations (up to 10 gm.), the incidence of infection falling from 40 to 16 per cent. and the yield simultaneously rising by from 63 to 77 per cent. The larger number of normal plants in the treated stands outweighed a slight toxicity of the fungicide at the maximum strength.

SCHROEDER (W. T.) & WALKER (J. C.). **Influence of controlled environment and nutrition on the resistance of garden Pea to Fusarium wilt.**—*J. agric. Res.*, lxv, 5, pp. 221–248, 4 pl., 4 figs., 1 diag., 5 graphs, 1942.

In greenhouse and laboratory experiments in Wisconsin a pea variety (Wisconsin Perfection) resistant to wilt, *Fusarium oxysporum* f. *pisi* race 1 (*F. orthoceras* var. *pisi*) [*R.A.M.*, xix, p. 2], and another (Davis Perfection) susceptible to it, were grown under controlled conditions of temperature and nutrition in sterile sand artificially infested by means of a suspension of microconidia and hyphal fragments. The optimum sand temperature for disease development in plants of both varieties was found to be 27° to 30° C. and thus higher than that established by other workers [ibid., viii, p. 215]. Air temperature had relatively little influence on wilt development. The fungus grew best at 28° when cultured in the same nutrient solution as that used for the sand cultures of the host, supplemented with 2 per cent. dextrose. In susceptible plants the severity of disease appeared to be directly proportional to the temperature within the range of temperatures studied (15° to 30°); a very slow wilt with leaf necrosis and abscission developed at low sand temperatures and a very rapid wilting at the highest; cortical decay occurred at all temperatures, but was most severe and involved only the lower internodes at the optimum temperature; at sand temperatures of 24° and 21° the fungus made the greatest progress up the stem. In resistant plants very slight incurving of the lower stipules and leaflets occurred at the low temperature and low nutrient concentration, and severe wilting at the very highest concentration and optimum temperature. At high temperatures and low nutrient concentration disease development in resistant plants was similar to that in susceptible ones at the low temperature.

When four nutrient solutions, differing only in total salt concentration and designated 0·1H (basal solution diluted to one-tenth), 1H (basal solution), 3H (concentration three times that of the basal), and 5H (concentration five times that of the basal solution), were used, the following disease responses were noted at different temperatures. At 21°, approximately the optimum temperature for the host, disease development in susceptible plants was retarded with an increase in the nutrient concentration, except in midwinter when light was poor and days were short; in resistant plants the disease was most severe in the 0·1H, less serious in the 1H, and absent in the higher concentrations. At 27° the disease was most severe in the 5H concentration, both resistant and susceptible plants developing severe cortical necrosis and rapid wilting; it was least severe in both resistant and susceptible plants in the 1H, and variable, but considerably more severe in the 3H solution, while in the 0·1H solution resistant plants developed severe slow wilting and susceptible ones wilted almost as rapidly as at the highest solution.

Microscopic examination of diseased resistant plants indicated extensive cortical and stelar penetration of the roots and stelar penetration of the first and second internodes, nodal isolation indicating still higher advances. Granular and gum-like depositions and scarcity of hyphal strands were observed in resistant plants at high temperature, but not in susceptible plants at either high or low temperature.

The results of cross-inoculations of susceptible and resistant varieties of tomato, cabbage, and pea plants with the respective fusarial wilt pathogens, *F. oxysporum* f. *lycopersici* (*F. bulbigenum* var. *lycopersici*) [ibid., xxi, p. 432], the cabbage yellows organism [*F. conglutinans*: ibid., xxi, p. 342], and *F. orthoceras* var. *pisi*, under conditions of high temperatures (27° to 28°) and low nutrition (0·1H concentration)

in sand culture, indicated that all three pathogens are specific to their respective hosts, producing no symptoms on the others although apparently capable of penetrating into them. Of the three species, only the pea wilt organism produced symptoms in both the resistant and the susceptible variety of pea.

DUNDAS (B.). **Breeding Beans for resistance to powdery mildew and rust.**—Abs. in *Phytopathology*, xxxii, 9, p. 828, 1942.

The reactions of segregating bean [*Phaseolus vulgaris*] populations to the various physiologic races of mildew [*Erysiphe polygoni*: *R.A.M.*, xx, p. 619] and rust [*Uromyces appendiculatus*: ibid., xx, p. 555] may be determined by means of detached leaflets in Petri dishes. Pinto and other field beans, as well as some garden varieties, carry a main dominant factor for resistance to 12 of the 14 races of *E. polygoni* isolated, which is being incorporated into the new garden beans in course of development. There is further a dominant factor for semi-resistance, which induces susceptibility five to seven days after emergence.

Various types of garden beans have been found to contain a number of factors for rust resistance, appropriate combinations of which should result in resistance to all the 20 known physiologic races of *U. appendiculatus*. A combination of the factors for resistance in Golden Gate Wax and Brown Kentucky Wonder 298 has been used in breeding for resistance to four races, and several of the newly released varieties have shown resistance to certain races of the rust.

ARK (P. A.) & GARDNER (M. W.). **Root scab of Carrot caused by Phytomonas carotae.**—Abs. in *Phytopathology*, xxxii, 9, p. 826, 1942.

A serious root scab of carrots is caused in California by direct infection with the agent of leaf and umbel bacterial blight, *Phytomonas* [*Xanthomonas*] *carotae* [*R.A.M.*, xiv, p. 211], the disease being chiefly prevalent in irrigated fields in which carrots have repeatedly been grown. The small, brown or maroon spots characteristic of the early stages of infection may develop into sharply sunken constrictions or large, rough, depressed cankers, while subsequent attacks induce the formation of laterally elongated, brown or black, rough, scabby lesions, often protruding by reason of the immense bacterial masses exuding and embedding particles of soil. A specially objectionable feature of the scab is the healing-over of internal pockets of blackened, infected tissue on roots with a fairly normal exterior. Secondary fungi may invade the scabbed roots. *X. carotae* is able to persist in field soil for periods up to six months, and diseased roots discarded at harvest time should be removed. Ten minutes' immersion of the seed in water heated to 50° to 52° C. is recommended to prevent the infestation of clean soil.

LIHNELL (D.). **Mosaikbränna—en virussjukdom på Spenat.** [Mosaic blight—a virus disease of Spinach.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, v, 6, pp. 83–86, 3 figs., 1941.

During the latter part of the summer of 1941, spinach in two localities of Scania (extreme south of Sweden) was severely attacked by 'blight', the agent of which was identified as *Cucumis* virus 1 [cucumber mosaic virus], this being the first authentic record for the country.

SHIFRISS (O.), MYERS (C. H.), & CHUPP (C.). **Resistance to mosaic virus in the Cucumber.**—*Phytopathology*, xxxii, 9, pp. 773–784, 4 figs., 1942.

For an understanding of the genetical mechanism involved in the manifestation of cucumber mosaic symptoms two developmental phases of the disease, viz., the cotyledon and composite true-leaf stages, must be clearly differentiated. The writers' inoculation experiments at the Cornell Agricultural Experiment Station, Ithaca, New York, on the resistant Chinese Long [*R.A.M.*, xi, p. 349], China, and Shamrock

varieties, the susceptible A(bbott) and C(obb), and Early Russian, and hybrids between Chinese Long and each of the two susceptible varieties yielded the following results. Three complementary genes appear to govern the ability or failure of the virus to induce cotyledonary chlorosis, the genetical ratio in the F_2 being 27 non-chlorotic to 37 chlorotic. This ratio undergoes constant changes at the composite true-leaf stage, when several gene-modifiers also participate in the genetical control of virus symptoms, so that the frequency of symptomless plants is extremely low (three out of 523 in the F_2). The presence or absence of cotyledonary chlorosis determines whether the tested plant is susceptible to, or tolerant of mosaic, and the degree of tolerance may be determined by the severity or mildness of the symptoms and by the relative distance from the cotyledons to the true leaf on which the symptoms first appear: the longer the distance, the greater is the resistance. All resistant stocks contain the three basic dominant genes, but they vary among themselves in the relative number of dominant modifiers.

The production by plant-breeders of symptomless cucumber varieties (which are economically superior to the 'tolerant' sorts with mild or severe symptoms on the first true leaf) involves the repeated crossing of symptomless selections with commercial types.

Bergström (Ingrid). **Knippbakterios på Melon m. fl. växter.** [Fasciation bacteriosis of Melon and other plants.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vi, 3, pp. 42–45, 4 figs. 1942.

The most recent occurrence of *Bacterium* [*Corynebacterium*] *fascians* in Sweden is on melon, other hosts of the pathogen in the country being *Chrysanthemum maximum* [*R.A.M.*, xviii, p. 317], *Nicotiana glutinosa*, and sweet pea, while a certain type of gall on *Viburnum opulus* is tentatively attributed to the same source.

Miller (L. I.). **Peanut leafspot and leafhopper control.**—*Bull. Va agric. Exp. Sta.* 338, 24 pp., 7 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 4, p. 534, 1942.]

The results of experiments in the control of groundnut leaf spots (*Cercospora* spp.) [*C. personata* and *C. arachidicola*] and the leafhopper [*Empoasca fabae*] on 70 farms in Virginia from 1938 to 1941 indicated that profitable yield increases may be secured by three to four applications of finely ground sulphur dust at fortnightly intervals [cf. *R.A.M.*, xxi, p. 402], the surplus thus obtained ranging from 238 to 834 (average 481) lb. nuts per acre on 30 farms. The increases in hay production on seven farms varied between 526 and 3,419 (1,674) lb. per acre. Both nuts and hay from the treated plants were of superior quality, ripening being delayed by five to ten days so that the crop could be left standing for a considerable period without appreciable loss of nuts through shredding. The inclusive cost of the treatment is estimated at $3 per acre.

Du Plessis (S. J.). **'n blaarvleksiekte van Wingerd veroorsaak deur Isariopsis fuckelii (Thüm.) Du P.** [A leaf spot disease of the Vine caused by *Isariopsis fuckelii* (Thüm.) Du P.]—*Ann. Univ. Stellenbosch*, Ser. A, xx, 1, pp. 1–26, 12 figs., 1942.

In this further paper on the vine leaf disease caused by *Isariopsis fuckelii* (Thüm.) comb. nov. in the Stellenbosch district of South Africa [*R.A.M.*, xxi, p. 278] the author gives a revised Latin diagnosis of the pathogen, which he transfers from the genus *Septosporium*. The fungus is characterized by basal, septate, simple, straight, densely caespitose, coremioid, fuscous conidiophores, arising from the pseudo-parenchymatous and subepidermal stromata, with plurigeniculate, flexuous, brown apices, 157·8 to 278·8 by 3·7 to 5·4 (average 217·8 by 4·4) μ, and elongate to clavate or subfusoid, brown, granular, 2- to 10-septate conidia, tapering towards the rounded apices and obtusely rounded at the base, 34·7 to 77·8 by 5·4 to 9·2 (50 by 7·1) μ. Saccardo's view of *S. fuckelii* as a synonym of *Cercospora roesleri* [ibid., xviii, p. 91] is rejected on the basis of differences in the spore shape, septation, and dimensions between the two species.

Plantesygdomme i Danmark 1940. Oversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1940. Survey of data collected by the State Phytopathological Experiment Station in 1940.]—*Tidsskr. Planteavl*, xlvi, pp. 495–565, 1942.

The following are among the items of interest in this annual survey of phytopathological work in Denmark [*R.A.M.*, xix, p. 6]. Copper deficiency [reclamation disease] was exceptionally severe among barley and oats, especially in Jutland. Sulphur pyrites ash, applied at the rate of 700 kg. per ha. in mid-June, gave somewhat better control of the disease than copper sulphate.

Only one case of *Puccinia graminis* was reported on wheat, from the south of Jutland.

Chlorosis of apple trees was effectively combated by soil treatment with manganese and iron sulphates at the rates of 200 and 300 kg. per ha., respectively.

Potato wart (*Synchytrium endobioticum*) was detected in 15 new municipalities.

New records for the country include *Colletotrichum agaves* on *Agave* [? *americana*: ibid., xvii, p. 600] and *Septoria linicola* [*Sphaerella linorum*] on flax.

Wissenschaftlicher Jahresbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, 1940. [Scientific Annual Report of the National Biological Institute for Agriculture and Forestry, 1940.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 65, 1941. [Abs. in *Z. PflKrankh.*, lii, 9–10, pp. 459–463, 1942.]

Among the items of phytopathological interest in this report on scientific research work at the Biological Institute, Dahlem, Berlin, during 1940 may be mentioned the following. [G.] Nitsche and [H.] Förster (pp. 99–100) state that beet heart and dry rot developed in an exceptionally acute form in the Guhrau and neighbouring districts owing to the shortage of borax. Equally effective control, however, was shown to be obtainable by treatment of the soil with boron-containing lignite ash. The latter product, as well as 'Müll' and North Sea slime, also gave satisfactory results in [E.] Pfeil's field experiments in the control of the same disease (p. 50).

Three distinct variants of the tobacco ring-spot virus [see below, p. 109] were isolated by [E.] Köhler from potato plants affected by aucuba mosaic. The same worker found 1 per cent. sodium lye an effective antiseptic for the treatment of knives used in the thinning-out of tomatoes and cutting of potatoes as a precaution against tobacco mosaic and potato virus X transmission (pp. 21–22) [*R.A.M.*, xx, p. 602].

E. Pfankuch's further studies (pp. 51–52) on the 'mutations' of the tobacco mosaic virus experimentally induced [by irradiation: ibid., xix, p. 437] showed that the rate of movement of such aberrant forms was uniformly slower than that of their progenitors. Similar 'mutations' could be isolated from plants which were perfectly healthy at the time of irradiation but were subsequently inoculated with non-irradiated virus. Evidence was obtained that differences in the effects produced by the virus and its mutants rest on qualitative and quantative divergences in the nucleic acid portion of the molecule.

In [K.] Heinze's field trials the Sensation cucumber variety (A/G Terra) was among the types showingr esistance to cucumber virus 1 [cucumber mosaic virus: ibid., xviii, p. 803], while a similar response to soy-bean mosaic [ibid., xx, p. 444] was exhibited by the Giessen and Dieckmann 1940 selections (p. 23).

The curl (star spot) disease of apricots and other Prunaceae described by Christoff from Bulgaria [ibid., xviii, p. 746] as due to a virus is thought by H. Wenzl (pp. 92–93) to result from quite a different cause, i.e., unduly drastic pruning of the young trees in the nursery.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 9, pp. 424–428; 10, pp. 467–471, 15 figs., 1942.

After stating that the New South Wales Department of Agriculture has for some years encouraged the local production of disease-free bean [*Phaseolus vulgaris*] seed,

chiefly in inland areas, and is prepared to inspect seed crops for certification, the author gives brief, practical notes on the symptoms and control of halo blight [*Pseudomonas medicaginis* var. *phaseolicola: R.A.M.*, xix, p. 646; xxi, pp. 358, 512], mosaic, anthracnose [*Colletotrichum lindemuthianum*: ibid., xvii, p. 716], *Fusarium* root rot [*F. solani* var. *martii*: ibid., xx, p. 195], angular leaf spot [*Isariopsis griseola*: ibid., xix, p. 326], 'scald' [ibid., xxi, p. 62], and rust [*Uromyces appendiculatus*: ibid., xxi, p. 244].

Local growers are advised to plant the resistant Tweed Wonder beans where losses from anthracnose are expected. The Stayley's Surprise variety is highly susceptible to root rot, and should be grown only in soil known to be unaffected; the other varieties commonly grown in New South Wales, viz., Tweed Wonder, Canadian Wonder, Hawkesbury Wonder, and Brown Beauty are moderately resistant to root rot, generally showing, when affected, only a slight reddening of the tap-root. The term 'scald' is applied to a non-parasitic condition found only in the Gosford-Wyong area; it is characterized by discoloration and death of portions of the leaf tissue. Affected plants are stunted and give a small yield; if numerous plants are attacked, crop failure may ensure. The first symptom of scald is a collapse of tissue between the main veins and along the edges of leaflets. The collapsed tissue is light greenish-, later yellowish-brown, and after this change, a withering of the tips or edges of leaflets, or of whole leaflets, may set in, imparting a blighted appearance to the plants. The condition is associated with seed raised and again planted in acid soils (P_H 4·2 to 5), while similar seed, planted in fertile soil of low acidity, gives healthy plants. Scalded plants contain several times as much manganese as healthy ones. The disease may be avoided on land where it is known to occur by planting seed raised in inland districts or in non-acid soils. Heavy applications of dolomitic lime a few months before planting are worth trying.

In experiments by H. Parry Brown on the control of apple and pear black spot [*Venturia inaequalis* and *V. pirina*, respectively], in New South Wales a spray of 0·1 per cent. sodium dinitro-ortho-cresylate [elgetol: ibid., xxi, p. 494] applied at the rate of 400 gals. per acre at the green-tip stage to the leaf refuse lying in the orchard reduced the number of affected apples and pears by 47 and 83 per cent. respectively, as compared with the unsprayed blocks, while the number of spots per fruit on those that were spotted was also fewer in the treated than in the untreated blocks. 'A floor spray' is, however, regarded as only supplementary to the normal spray programme, and, further, must be made over an area of at least two acres, as the wind dispersal of the spores from the unsprayed areas would nullify the effect of the treatment if it were applied to a smaller area.

Brief notes are also given on cucurbit diseases and their control.

GARDNER (A. D.) & CHAIN (E.). **Proactinomycin: a 'bacteriostatic' produced by a species of Proactinomyces.**—*Brit. J. exp. Path.*, xxii, 3, pp. 123–127, 1942.

Proactinomycin, a substance produced by a species of *Proactinomyces* Waksman, occurring as a contaminant of bacterial cultures at the Sir William Dunn School of Pathology, Oxford, was shown to inhibit the growth of various bacteria, e.g., *Streptococcus pneumoniae* (types 13 and 22) at a dilution of 1 in 1,500,000. In comparison with penicillin proactinomycin has the disadvantage of much greater toxicity (in tests on mice and human leucocytes), but, on the other hand, it is more stable and chemically more amenable.

WAKSMAN (S. A.), HORNING (ELIZABETH S.), & SPENCER (E. L.). **The production of two antibacterial substances, fumigacin and clavacin.**—*Science*, N.S., xcvi, 2487, pp. 202–203, 1942.

In a study of the presence of antagonistic fungi in nature, two species of *Aspergillus*, *A. fumigatus* (16 strains from soils) and *A. clavatus* (three strains from stable manure), were found to produce active substances, designated fumigacin and clavacin, respec-

tively, which differed greatly in their chemical nature and biological activity. Fumigacin is particularly active against Gram-positive bacteria and clavacin against Gram-negative. The substance recently isolated by Wiesner from *A. clavatus* [*R.A.M.*, xxi, p. 283] appears to be similar to, if not identical with, clavacin.

PAVLOFF (K.). **Wheat No. 11—agronomic and botanical description.**—*Rev. Inst. Rech. agron. Bulg.*, ix, 4, pp. 45–78, 1939. [Abs. in *Plant Breed. Abstr.*, xiii, 1, pp. 34–35, 1943.]

The new wheat No. 11, which is stated to be widely grown in south-western Bulgaria, where the crop is assuming increased importance in comparison with rye and rye-wheat mixtures, has been found by [D. N.] Dodoff to be highly resistant to two out of the three physiologic races of *Puccinia glumarum* recorded in the country [*R.A.M.*, xviii, p. 734] and susceptible to the third, as well as to all 12 races of *P. triticina* recognized in Bulgaria [ibid., xvii, p. 226]. The variety is resistant to five, and moderately so to one, of the 13 races of *P. graminis* found in the country, but highly susceptible to the remaining seven. Under field conditions No. 11 shows a fair degree of resistance to *P. graminis* and *P. glumarum* and is free from infection by *Ustilago tritici*, but its susceptibility both to *P. triticina* and *Tilletia* species [*T. caries* and *T. foetida*] is appreciable. Notes are also given on the reaction of other wheat selections to the foregoing fungi.

MOURASHKINSKY (K. E.). О качестве воды при термическом обеззараживании семян. [On the quality of water used in heat disinfection of seed].—*Ex* К весеннему севу 1942 года. Сборник статей. [On the occasion of spring sowing in 1942. Collection of papers], pp. 29–32, Издат. Наркомзема СССР. [Publ. Off. People's Comm. Agric. U.S.S.R.], Omsk, 1942.

It is pointed out that the majority of the installations for hot-water treatment of cereal seed-grain in the Soviet Union are operated in such a way that both the presoaking and the actual heating of seed-grain is made repeatedly in one and the same water, usually changed only once in 24 hours. By the end of the day the water is very alkaline, the colour of strong tea, and emits a penetrating smell of decay. The results of two experiments in which the seed-grain was treated in fresh or stale water showed that the emergence and the intensity of growth of seedlings in the first few days was impaired when the water was not changed after each operation.

MACHACEK (J. E.) & WALLACE (H. A. H.). **Non-sterile soil as a medium for tests of seed germination and seed-borne disease in cereals.**—*Canad. J. Res.*, Sect. C, xx, 11, pp. 539–557, 1942.

In greenhouse experiments conducted in Canada from 1939 to 1941 [cf. *R.A.M.*, xxi, p. 366] non-sterile soil was found to be a very satisfactory medium for testing seed germinability and certain seed-borne diseases of cereals, offering at the same time more resemblance to the natural conditions obtaining in the field than most other tests. The best results were obtained with a friable sand-soil mixture kept moderately moist and at a temperature of 20° C. This mixture did not become seriously depleted even after six months of continuous use and showed very little variability in the results obtained. In comparative tests for germinability, seed-borne disease, and physical injury with 120 different lots of seed, those in non-sterile soil gave equally good results with experiments in autoclaved soil, but had the advantage of being more easily handled and saving the time and labour involved in soil sterilization; they were on the whole comparable to tests on moist paper or on nutrient agar in Petri dishes, and were superior to both in measuring the amount of physical damage. With barley seed infected with *Helminthosporium teres* a plating test was necessary to indicate infection, but even this test apparently failed to differentiate between virulent and non-virulent strains of the fungus.

Tentative recommendations, based on tests in non-sterile soil with several thousand

seed lots, are given in tabular form. Seed disinfection with organic mercury dust is recommended where the spore load of smuts (covered smuts of wheat, oats, and barley, and loose smut of oats [*Tilletia caries* and *T. foetida*, *Ustilago kolleri*, *U. hordei*, and *U. avenae*, respectively]) exceeds 1:128,000 or where seed decay or seedling blight reduces the percentage of healthy seedlings from non-disinfected seed below 91; increases in rate of seeding are recommended when the percentage of healthy seedlings, even after seed disinfection, is less than 91 but more than 50 per cent.; seed germinating 50 per cent. or less after disinfection should be discarded.

HWANG (L.). **The effect of light and temperature on the viability of urediospores of certain cereal rusts.**—*Phytopathology*, xxxii, 8, pp. 699–711, 1942.

A tabulated account is given of the writer's greenhouse experiments at St. Paul, Minnesota, to determine the effects of sunlight and temperature on uredospore viability in physiologic races 1 and 45 of *Puccinia coronata*, 11, 36, 38, and 56 of *P. graminis tritici*, 2 and 6 of *P. g. avenae*, *P. g. secalis*, and *P. rubigo-vera tritici* [*P. triticina*], the standardized methods of inoculation and incubation used being fully described.

The uredospores of *P. g. tritici* race 36 survived two days' exposure to a temperature of 44° C., and even after 60 hours, 8 per cent. germination was recorded, whereas after two days at 50°, only 1 per cent. were still viable, and at 60° more than half the spores were killed within four hours and nearly all were dead after 15. Under natural conditions in the Upper Mississippi Valley such high temperatures never obtain, though upwards of 40° is on record for Minnesota.

In the sunlight-resistance trials, over 10 per cent. of the spores of *P. g. tritici* (races 38 and 56) withstood 270 hours' exposure to an intensity corresponding to that of 500 to 1,500 foot-candles, the viability of race 36 being more severely impaired (1 per cent. survival): at an intensity reaching a daily maximum of 7,000 foot-candles a minimum of 10 per cent. of the spores of all three races (28 in the case of 56) were still viable after 75 hours but none survived 270 and only a trace of germination was perceptible in race 56 after 175 hours, to which the other two succumbed. Under the intensive sunlight, sometimes exceeding the power of 10,000 foot-candles, of a June day in Minnesota, the survival period of the cereal rust uredospores may well be even shorter than indicated by the experimental data, which were similar for the other isolates included in the trials.

In order to determine the relative effects on the uredospores of different qualities of direct sunlight, colourless, red, and blue cellophane filters and black paper were used to cover the exposure dishes. In general, viability declined more rapidly under the colourless filter than under the other coverings, *P. g. secalis* being an exception to the rule and losing its germinability uniformly in each series. An important aspect of the rust epidemiology situation concerns the ability of the spores to survive periods of deposition on the leaves of their hosts pending the advent of suitable moisture conditions for germination and infection. The results of experiments on potted seedlings of the susceptible Marquis wheat with *P. g tritici* 36 and *P. triticina* and the semi-resistant Anthony oats varieties with *P. coronata* indicated that, even after exposures of four days or longer, with 48 hours of direct sunlight, a high incidence of infection was secured within 10 to 12 days after the supply of adequate humidity for germination.

HASSEBRAUK (K.). **Mit Hilfe neuer Testsorten durchgeführte Untersuchungen über die physiologische Spezialisierung von Puccinia triticina Erikss.** [Studies on physiologic specialization in *Puccinia triticina* Erikss., carried out with the help of new test varieties.]—*Arb. biol. Anst.*(*Reichsanst.*), *Berl.*, 23, pp. 37–51, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 1, p. 31, 1943.]

The results of tests of the physiologic races of wheat brown rust (*Puccinia triticina*) on an extended range of differential hosts revealed the existence of composite groups [*R.A.M.*, xviii, p. 731]. By the use of the varieties Mette's Rauhweizen, White Club

Spelt, Rüfenach 6, Red Tirol Spelt, Rottweiler Red Dinkel St. VI, Sicilian Dinkel, Svalöf's Sonnen I, Hildebrandt's White Victoria, Loosdorfer III, Köstlin's Hohenheim Hybrid, Jäger's Alb, Abundance Gold Coin (a), and Malakoff, 45 new physiologic races have been determined. In the author's opinion, the differential hosts most appropriate for use in one country are not necessarily the best for another, and he further considers that the complexity of *P. triticina* in respect of its biological specialization may unfit it for continued studies along these lines.

MEAD (H. W.). **Environmental relationships in a seed-borne disease of Barley caused by Helminthosporium sativum Pammel, King, and Bakke.**—*Canad. J. Res.*, Sect. C, xx, 11, pp. 525–538, 1942.

In further experiments on the disease of barley caused by *Helminthosporium sativum* [*R.A.M.*, xxii, p. 55] seedlings grown in the greenhouse or in field plots from infected seed were found to suffer greatest damage under conditions unfavourable to the host, such as high temperature combined with excessive moisture or low temperature with low moisture. The strongest plants and best stands from diseased seed were obtained at 15° to 18° C. in moist soil. The microflora of the soil had little influence on the disease. Packing of the soil caused a significant reduction in emergence and an increase in the amount of seedling blight and stunting. Fertilization with ammoniated superphosphate (2–19–0) caused an insignificant reduction in emergence due to increased pre-emergence blighting; fertilized seedlings were more severely infected, but those that survived grew more vigorously than unfertilized ones. The reduction of the oxygen content of a nutrient solution and of soil from 21 to 10 per cent. caused stunting of the seedlings and reduced the amount of infection, this being interpreted as a result of slower metabolism of both the host and the parasite. The raising of the carbon dioxide content in the atmosphere of the soil to 1·25 per cent. increased the amount of infection. It is concluded that infected barley seed should be sown in cool, moist, and well-aerated soil.

ADAIR (E. O.). **Arkansas Oat hybrid shows great promise. Extensive field trials prove De Soto has marked resistance to rust and smut in addition to being high-yielding strain.** —*Sth. Seedsm.*, v, 8, pp. 7, 31, 1942. [Abs. in *Plant Breed. Abstr.*, xiii, 1, p. 37, 1943.]

The DeSoto oats variety, a cross between the Argentine Victoria and the winter-hardy Lee, is stated to combine resistance to crown rust [*Puccinia coronata*] and smut [*Ustilago avenae* and *U. kolleri*] with freedom from winter injury.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **Observations on ergot in cereal crops.**—*J. agric. Sci.*, xxxii, 4, pp. 457–464, 2 pl., 1942.

Examination of the records of ergot (*Claviceps purpurea*) in cereals during the past 24 years in England indicated that the fungus occurs more commonly on rye than on wheat, while it is less frequently found on barley, and is even more rare on oats. A more detailed study of the records from 1939 to 1942 showed that the disease is most prevalent in the northern parts of the country; of 500 acres of rye surveyed in Suffolk and Norfolk in 1942, only 80 showed a trace of ergot. It has been observed on several occasions on Rivet wheat, and it has been recorded on Rivet and *Triticum vulgare* crosses; only one case has been found on oats.

The percentage by weight of ergot in the threshed grain of the barley crops examined ranged from 0·03 to 0·88 per cent., the alkaloidal content of the only sample assayed being 0·216 per cent., calculated as ergotoxin.

As the feeding of contaminated grain to cattle is undesirable, a cleaning method was devised; the barley was first soaked for three hours in water and the floating fraction removed by skimming; the water was then drained away and replaced by solutions of 14·5 to 17 per cent. sodium chloride or 16 to 19 per cent. potassium chloride, all floating material being again removed after successive stirrings. The solution was then drained

off, and the grain washed, dried, and weighed. The effect of the pre-soaking is to reduce loss of grain in the skimming considerably, without appreciable reduction in the amount of ergot removed. The sodium chloride treatment increased germination, while potassium chloride slightly reduced it.

PORTER (C. L.). **The effect of bacterial contamination upon the subsequent growth of fungi in the same medium.**—*Proc. Ind. Acad. Sci.*, xlix (*1939*), pp. 75–76, 1940.

Repeated tests at Purdue University, Indiana, indicated that a bacterium closely allied to *B[acillus] subtilis* is capable of producing substances in potato dextrose agar cultures which are sharply inhibitory both to *Fusarium moniliforme* [*Gibberella fujikuroi*] and *Diplodia zeae*. These products remain stable under exposure for half an hour to temperatures up to 250° F. Even after 30 minutes' sterilization at 15 lb. pressure, the contaminated substratum was unable to support the growth of the fungi under observation [cf. *R.A.M.*, iii, p. 471].

BEARD (D. F.). **Relative values of unrelated single crosses and an open-pollinated variety as testers of inbred lines of Corn.**—*Abstr. Doct. Diss. Ohio Univ.* 33, pp. 9–18, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 1, p. 40, 1943.]

Twenty-one crosses between seven inbred lines of maize and three test varieties, viz., one open-pollinated, Eichelberger Clarage, and two single crosses, 56 × Hy and 73 B × Mc 401, were studied in respect of smut [*Ustilagoz eae*] infection and four other characters, the conclusion being reached that single crosses are at least equal to open-pollinated varieties for testing inbreds, besides offering certain specific advantages due to their greater uniformity.

In a second series of trials susceptibility to *Diplodia zeae* was investigated in a number of inbreds and their single and top crosses. A correlation of +0·77 was observed between the susceptibility of inbreds and that of their respective top crosses, so that the degree of susceptibility of hybrid combinations may be forecast from the performance of the constituents inbreds. The ranking of the various inbreds with regard to susceptibility differed significantly according to the location of the test.

LUDBROOK (W. V.). **Top rot of Maize, Sweet Corn, and Sorghum.**—*J. Coun. sci. industr. Res. Aust.*, xv, 3, pp. 213–216, 1 pl. [between pp. 252–253], 1942.

During the past three seasons scattered maize, sweet corn, and sorghum plants in parts of Victoria, New South Wales, and, apparently, South Queensland, have shown a condition in which, in the month preceding tasselling, the immature uppermost leaves are dead, dry, and bleached. When the dead leaves are pulled out, the top of the stem generally also becomes detached. The stem apex, immature tassel, and bases of the topmost leaves are destroyed by a wet, soft rot which emits a characteristically offensive odour. If the stalk is split longitudinally, a grey or brownish water-soaked rot of the parenchyma is found descending from the apex. Apical growth becomes arrested, and no tassel or grain develops, but vigorous suckers are, as a rule, produced from the base. Sorghum plants often develop laterals from the node below the rotted area.

Numerous isolations during three seasons from affected maize, sweet corn, and sorghum gave several types of bacteria, sometimes in association with *Gibberella fujikuroi* var. *subglutinans*, the fungus occasionally occurring alone. Inoculation tests demonstrated that some of the bacteria were saprophytic and others weakly pathogenic, but one organism repeatedly gave rise to characteristic symptoms. It has not yet been identified. It is a minute, motile, Gram-negative rod, forming small, circular, yellowish-white, raised, glistening, slightly translucent to opaque colonies, with slightly crenulate margins, sometimes becoming amoeboid in old, widely spaced colonies; liquefying gelatine rapidly in plates, and slowly, from the surface down, in stab cultures; forming acid and gas with sucrose, mannite, and dextrose, but not with lactose or maltose; coagulating litmus milk without acidification; forming little or no

indol; and reducing nitrate to nitrite: it rapidly rotted slices of potato, onion, carrot, tobacco stem, and cucumber. This isolate showed a marked decline in pathogenicity when maintained in culture and it is thought that some of the other organisms may be pathogenic when freshly isolated.

According to local growers the condition is probably favoured by careless harrowing or scarifying of seedlings, submergence of the plants for a few hours by flood, and grub injury.

NOTINI (G.) **Grönmykosen som bekämpningsmedel.** [Green mycoses as insecticides.] —*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vi, 2, pp. 29–32, 2 figs., 1942.

In a comparative experiment at a market-garden near Stockholm, where the larvae of the grain Noctuid *Agrotis* [*Euxoa*] *segetum* were troublesome, applications of arsenic dust, pyretin, and conidial suspensions of *Metarrhizium anisopliae* [*R.A.M.*, xviii, p. 380], resulted in a mortality of 0, 23, and 80 per cent., respectively. The lethal effects of the fungus were still apparent in the cold frames a year after inoculation.

DEY (N. C.) & MAPLESTONE (P. A.). **Tinea imbricata in India.**—*Indian med. Gaz.*, lxxvii, 1, pp. 5–6, 1942.

The results of the authors' studies on five cases of tinea imbricata in Assam confirms the supposition of Acton and Ghosh that the disease is due to *Endodermophyton indicum* [*Trichophyton concentricum*: *R.A.M.*, xiv, p. 35], of which *E.* [*T.*] *castellanii*, *E.* [*T.*] *tropicale*, and *E. mansoni* are regarded as synonyms. The contention of the previous investigators that the genus *Endodermophyton* should be merged in *Achorion* is also upheld.

EDGECOMBE (A. E.). **Trichophyton purpureum (Bang) and Trichophyton gypseum (Bodin): differentiation in culture.**—*Arch. Derm. Syph., Chicago*, xlvi, 5, pp. 651–660, 2 figs., 1942.

In comparative studies at the College of Physicians and Surgeons, Columbia University, New York, on 20 strains of *Trichophyton purpureum* and 15 of *T. gypseum*, potato agar proved to be the best of seven culture media tested for differential purposes. A downy-looking surface with a white or pinkish colour above and the consistent development of a dark reddish-purple pigment in the submerged portion were characteristic of *T. purpureum*, while *T. gypseum* formed powdery colonies, white to cream above and the lower part uniformly occupied by a dull salmon-coloured pigment. Exposed to filtered ultra-violet rays, young cultures of *T. purpureum* exhibited a clear, pale blue fluorescence, whereas that emitted by *T. gypseum* was of a purple-violet tone.

In microscopic culture mounts the strains of *T. purpureum* were invariably devoid of spiral elements and formed elongate to piriform microconidia, 5 by 3 μ, and cylindrical, 2- to 10-septate, parallel-sided macroconidia, 60 by 6 μ. *T. gypseum* produced an abundance of spiral elements on potato and maize meal agars, oval to piriform microconidia, 3·5 by 2·5 μ, and clavate or piriform to cylindrical, 4- to 8-septate macroconidia, 45 by 8 μ.

Indian Central Jute Committee. Annual Report of the Agricultural Research Scheme for the year 1940–41.—56 pp., 5 pl., 1941.

Section VII of this report (pp. 31–39) presents the following information on jute diseases in India [*R.A.M.*, xx, p. 166]. Observations on 50 one-month-old plants attacked by stem rot (*Macrophomina phaseoli*) in the field showed that infection originated at the leaf margin and apex, whence it proceeded through the midrib to the petiole and finally to the nodal region of the stem. Rapid spread of foliar infections, involving necrosis of the entire leaf under favourable (very wet) weather conditions, took place between 18th and 25th June. The diseased leaves persisting on the stem left a discoloured patch, up to 2 to 2½ in. long, at the point of contact. The lesions

coalesce into long streaks in which, at an advanced stage, shredding of the epidermis and cuticle takes place. Adventitious terminal roots are produced at the ends of the streaks. Generally speaking, stem rot was much more prevalent in Eastern Bengal during the period under review than in 1939 to 1940, especially in upland crops. In two areas of the Dacca district a virulent and widespread epidemic of atypical form first observed three or four years ago and affecting 10 to 50 per cent. of the stands occurred during August. The formation of a number of coalescent cankers leads to rupture of the epidermal tissues and the breaking-off of diseased plants at the site of invasion. Neither sclerotia nor pycnidia could be detected on the rotted stems, isolations from which, however, yielded typical cultures of *M. phaseoli*.

Although none of the 49 varieties tested gave any indication of true immunity from stem rot, there is some possibility of obtaining resistant selections from *C[orchorus] capsularis* types such as D.154×27, Kalichar, and Barapat Rd. U. F. 2·06, while *C. olitorius* R.26 may likewise provide a useful parental stock. The comparative tolerance of the *olitorius*, as opposed to the *capsularis*, group of jute varieties is attributed to the slow progress of *M. phaseoli* in the leaves of the former, which drop off before invasion is completed, thereby saving the stem from attack. Twenty-day-old seedlings, dipped in a suspension of a stem-rot culture and transplanted in sterilized soil, developed typical damping-off symptoms, 85 per cent. of those inoculated succumbing to the disease and yielding *M. phaseoli* on reisolation. Negative results were given by similar tests on plants of 2½ months, and variable data were obtained in the case of one-month-old seedlings transplanted in infested soil. Only localized infection occurred on *C. acutangularis* plants inoculated through wounds in the branches.

A reasonable reduction in the incidence of stem rot, without appreciable impairment of germination, was secured by seven minutes' immersion of the seed in water heated to 58° C., ten at 57°, or 20 at 56°. The addition of two drops of 10 per cent. Castile soap per 10 c.c. water facilitated the evacuation of air under a water pump, thereby avoiding the need for pre-soaking of the seed and enabling it to withstand 15 minutes' treatment at a temperature range of 30° to 57°, beyond which point viability began to decline and fell markedly at upwards of 63°. From 40° onwards there was a gradual reduction in stem rot, but even at 70° a few (0·3 per cent.) seedlings were still affected, while at 63° the incidence of infection amounted to 5 per cent.

The best-yielding fertilizer treatment, consisting of nitrogen, potash, and lime, resulted in a reduction of stem rot and an increase of chlorosis, the latter, however, being without appreciable effect on output. The D.386×R.85 and D.154×D.27 selections are comparatively resistant to chlorosis and the second also to stem rot.

Sclerotium rolfsii was isolated from flowering or capsule-bearing jute plants suffering from a collar rot causing shredding and desiccation of the epidermal and cortical tissues and collapse of the stems.

A species of *Phomopsis* was identified by the Imperial Mycologist as the agent of black, oval, necrotic, sometimes coalescent lesions on the stems of mature plants. In the retted fibres periderm was observed to persist at the site of the spots.

GRUMBACH (H.). **Auch der Lein muss gebeizt werden!** [Flax must be treated too!]—*Kranke Pflanze*, xix, 3–4, p. 37, 1942.

The results of experiments reported in *NachrBl. dtsch. PflSchutzDienst*, xxii, 2, 1942, showed that the application to flax seed of a fungicidal dust not only effectively combated the seed-borne pathogens, *Fusarium* [*lini*], *Botrytis* [*cinerea*], and *Colletotrichum* [*lini*], but exerted a stimulatory action on germination. The control plots yielded 736 healthy and 622 diseased plants and those treated at the rate of 200 gm. dust per 100 kg. seed 1,614 and 17, respectively. In similar tests at the Dresden Technical College in 1941, only 2 per cent. diseased plants were counted in the plots treated with an approved dust, e.g., abavit, ceresan, fusariol, or germisan, as against 22 per cent. among the controls. The treatment further tended to increase the strength of the fibres.

SCHÖNLEBER (KLARA). **Die Zerstörung von Flockenflachsfasern durch Bakterien und Pilze.** [The destruction of carded Flax fibres by bacteria and fungi.]—*Bastfaser*, ii, pp. 86–91, 1942. [Abs. in *Chem. Zbl.*, cxiii (ii), 16, pp. 1865–1866, 1942.]

Fungi predominated over bacteria in the enzymatic disorganization of carded flax fibres in the writer's studies at the Kaiser Wilhelm Institute for Bast Fibre Research, Sorau, Lausitz, Germany, one species of *Penicillium* in particular being responsible for a striking vinous and bluish-purple discoloration and the partial to complete destruction of individual fibres [cf. *R.A.M.*, xxi, p. 453]. Accurate observation of the damage was facilitated by the use of chlor-zinc iodine and of hanging-drop nutrient solutions.

MACHACEK (J. E.) & BROWN (A. M.). **Preliminary investigations on mechanical injury in Flax seed.**—*Phytopathology*, xxxii, 8, pp. 733–734, 1942.

Cracking of flax seed due to mechanical injury in threshing operations was very severe in Western Canada in 1940, reducing germination by about half, the damage thus induced being apparently similar to that described by Stevens (*J. agric. Res.*, li, pp. 1093–1106, 1935) and Härtel (*C. R. Ass. int. Ess. Sem.*, ii, pp. 213–223, 1936) from the United States and Germany, respectively. In greenhouse tests the rotting of cracked seeds was completely prevented by dusting with ceresan or half-ounce leytosan at the rates of 1½ and 2 oz. per bush, respectively, the average germination of 362 samples collected in 1940–1 being about doubled by the treatment. In field experiments on Redwing seed at Winnipeg and Morden, Manitoba, treatment with ceresan raised the yield from cracked samples to the level of that from undamaged ones.

BJÖRLING (K.). **Undersökningar rörande Klöverrötan. II. Studier av utvecklingshistoria och variation hos Sclerotinia trifoliorum.** [Investigations relating to Clover rot. II. Studies on the life-history and variation of *Sclerotinia trifoliorum*.]—*Medd. Växtskyddsanst., Stockh.*, 37, 154 pp., 148 figs., 1942. [German summary.]

Continuing his studies on the causal organism of clover rot (*Sclerotinia trifoliorum*) [*R.A.M.*, xviii, p. 684], the author found that the development and anatomy of the sclerotia agree in the main with the facts already observed in connexion with *S. sclerotiorum* [ibid., viii, p. 607]. Apothecial production was experimentally shown to be strongly influenced by environmental conditions, especially temperature and light. Two distinct processes are involved in the development from the apothecia of the haploid mycelium and the dicaryophase, the former taking place in darkness, whereas the latter requires a certain amount of light. The ascogenous hyphae are two kinds: primary without clamp-connexions and secondary with them, nuclear and cellular division in the latter proceeding in the same manner as among the higher Autobasidiomycetes. Comparative studies on *S. sclerotiorum* and *S. borealis* [see next abstract] showed the cytology of all three species to be essentially analogous [cf. ibid., xvi, p. 160; xix, p. 559]. *S. sclerotiorum* appeared to posses six chromosomes.

The enhanced virulence of the pathogen during the autumn and winter, that is to say, within a temperature range significantly below its optimum, is attributed less to a decline in the vitality of the host than to a plentiful access of inoculum and, more particularly, to the higher relative humidity.

The culture of different biotypes of *S. trifoliorum* on the same agar plate resulted in the formation of white lines of microconidia in the zones of contact. From a detailed analysis of the abundant material at his disposal, the author concludes that the fungus consists of a number of physiologically dissimilar races, which are, however, often almost indistinguishable or identical in their morphological characters. These biotypes are self-fertile and, as a rule, homocaryotic. Hybridization between different races led to the production of heterocaryotic sclerotia and apothecia, the spore progeny of which was analysed and shown to be exclusively composed of new biotypes, the parent races not being represented in any of the tests. This phenomenon is interpreted as an effect

of heterosis, of some importance as a means of increasing variation within the species and undoubtedly affording scope for the development of new pathogenic races.

A brief discussion of the bearing of these observations on breeding clover for resistance to *S. trifoliorum* is given.

EKSTRAND (H.). **Årets vinterskador på höstsäd och vallar.** [The year's winter injury to autumn cereals and grasses.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vi, 3, pp. 38–42, 3 figs., 1942.

In the south-east of Sweden the snow mould (*Fusarium*) [*Calonectria graminicola*] and *Typhula borealis* [*R.A.M.*, xx, p. 252] were chiefly responsible for winter injury to rye in 1941–2. In the north, on the other hand, and in the rye-growing district round Kristianstad, *C. graminicola*, usually abundant, was almost entirely absent, its place being taken by *Sclerotinia borealis* [loc. cit.]. *S. trifoliorum* [see preceding abstract] caused little damage to clovers except in a few localities, mostly those in which the snow mould was prevalent.

DREGNE (H. E.) & POWERS (W. L.). **Boron fertilization of Alfalfa and other legumes in Oregon.**—*J. Amer. Soc. Agron.*, xxxiv, 10, pp. 902–912, 3 figs., 1 graph, 1 map, 1942.

The results of plant and soil analyses in the Willamette Valley, Oregon, indicate that a normal level of boron in lucerne is of the order of 20 p.p.m., and that 1 p.p.m. available in the surface soil should suffice to prevent the development of 'yellow top' [*R.A.M.*, xxi, p. 494] and give satisfactory yields. Sandy peat and aged leached soils are lowest in boron content and therefore respond most readily to treatment with borax or boric acid at the rates of 30 to 60 lb. per acre and two-thirds that amount, respectively, a 30 lb. application of borax remaining effective for about three years. The best times for the use of the fertilizer are autumn in the arid section and early spring in the humid region of the State.

SPRAGUE (R.). **Cercosporella eyespot of Kentucky Bluegrass.**—*Phytopathology*, xxxii, 8, pp. 737–738, 1 fig., 1942.

Cercosporella poagena n. sp., the agent of an 'eye spot' of Kentucky bluegrass (*Poa pratensis*) in the Willamette Valley, Oregon, is characterized by hyaline conidiophores and hyaline, elongated, broadly filiform to obclavulate, 4 to 7 (mostly 4)-septate conidia, 45 to 90 by 3·6 to 5 (45 to 75 by 3·6 to 4·6 in the type) μ, with blunt, tapering bases and abruptly acuminate or attenuated apices. The lesions produced by *C. poagena* on the leaves of its host are circular to elongated, light brown, with a straw-coloured centre and yellowish border, and are therefore quite distinct from the ashy to stramineous, pycnidia-bearing spots associated with *Septoria macropoda* Pass. var. *septulata* (Gz. Frag.) comb. nov. (*S. poae-annuae* var. *septulata* Gz. Frag.), and those due to *Helminthosporium vagans*, which have dark to nearly black centres (sometimes turning lighter) and prominent, reddish-brown borders. Evidence obtained while making comparative studies on *C. poagena* indicated that *Napicladium gramineum* Peck and, in the opinion of Chupp, probably *Cercospora poae* Baudyš & Picb. are synonyms of *Scolecotrichum graminis* [*R.A.M.*, xviii, p. 587].

NEGRONI (P.) & FISCHER (IDA). **Estudio micológico de trienta cepas de Pullularia (Dematium) pullulans.** [A mycological study of 30 strains of *Pullularia* (*Dematium*) *pullulans*.]—*Rev. Inst. bact., B. Aires*, xi, 1, pp. 99–108, 7 pl., 1942. [English and French summaries.]

The physiological characters of the 30 strains of *Pullularia pullulans* from fruit, leaves, and air studied in pure culture on beer wort agar and other standard media were remarkably uniform, and the slight morphological differences between them are not regarded as sufficiently important to justify specific or varietal distinctions. In general,

the colonies are black, folded, moist, and glistening. The hyaline, elliptical blastospores measure 2 to 14 by 1·5 to 5·6 (average 7 by 3 to 3·5) μ and arise from the hyaline, septate, branched mycelium in two ways, (a) by budding and (b) on small pedicels (pseudoconidial type); they are disposed round the hyphae like a small cuff, three or four cell layers in thickness (*Rhinocladium* type) [*R.A.M.*, ix, p. 246], often forming clusters (*Mycotoruloides* or *Mycotorula*) or branched lateral or terminal chains (*Mycocandida*) [ibid., xviii, p. 525]. At times several blastospores may be formed on the enlarged end of a short branch in a manner reminiscent of an *Aspergillus* head, or clusters of bacilliform spores may be produced. Other organs produced by the mycelium include arthrospores and hyaline or fuliginous chlamydospores of the dictyospore, bulbil, or nodular organ type, the last-named sometimes bearing peripheral blastospores resembling those of *Sarcinomyces*.

The optimum growth temperature was about 23° C. Dextrose, maltose, lactose, raffinose, and a small amount of galactose were utilized as sources of carbon, while nitrogen was supplied by peptone, asparagin, ammonium sulphate, potassium nitrate, and (to a slight extent) urea. Milk was coagulated and peptonized and gelatine liquefied.

The systematic position of *P. pullulans* is considered to be among the Fungi Imperfecti (Hyphomycetes), order Thallosporales Vuill., 1910, sub-order Blastoarthrosporineae Puntoni, 1938, family Trichosporaceae Nannizzi, 1931.

Fisher (D. F.). **Handling Apples from tree to table.**—*Circ. U.S. Dep. Agric.* 659, 39 pp., 17 figs., 1 graph, 1942.

Included in this useful summary of the correct methods of handling apples to insure their prime condition on arrival in the American market are notes on the factors conducive to the development of fungal diseases, notably blue mould (*Penicillium expansum*) and physiological disorders, e.g., bitter pit, Jonathan spot, water core, internal breakdown, soft scald and soggy breakdown, and scald, and on the means of obviating or combating these defects.

Montgomery (H. B. S.) & Shaw (H.). **Laboratory tests of bactericides on the Plum and Cherry bacterial canker organism (Pseudomonas mors-prunorum Wormald). I. The toxicity of some inorganic materials, especially copper compounds, and the effect of hydrogen ion concentration on the organism.**—*Ann. appl. Biol.*, xxix, 4, pp. 399–403, 1942.

In laboratory tests conducted at East Malling in 1939 the toxicity of 29 metals used in the form of soluble salts (mostly nitrates, otherwise chlorides) to *Pseudomonas mors-prunorum* [*R.A.M.*, xxi, p. 25] was determined as follows. Mercury, silver, gold, uranium, and copper, in descending order, were found to be the most toxic of the materials tested. The toxicity of both soluble and insoluble copper salts varied to an extent that could not be explained by differences in hydrogen-ion concentration, but the outstanding activity of Bordeaux mixture was found to be due to the alkalinity produced by the lime component. The limits of tolerance of the organism to hydrogen-ion concentration was about P_H 3·2 to 10·4.

Archibald (E.) & Wann (F. B.). **The zinc content of 'little leaf' and normal leaves.**—Abs. in *Amer. J. Bot.*, xxix, 8, p. 694, 1942.

In a paper read before the Pacific section of the Botanical Society of America at a meeting held at Salt Lake City, Utah, 15th to 18th June, 1942, the authors stated that fruit trees in certain parts of Utah are seriously affected by little leaf, but that zinc sulphate applied as a foliage spray gave good control [cf. *R.A.M.*, xx, pp. 449, 479]. Chemical analysis in diseased and healthy peach, cherry, apple, and plum leaves revealed little or no transverse movement of zinc in the plant, and a higher zinc content in leaves sprayed with zinc sulphate than in those treated by any other control method. The zinc content of the leaves was not increased by zinc soil treatments. Little-leaf

symptoms developed on trees with less than 123 microgm. zinc per gm. of dry matter, whereas healthy leaves contained 123 to 345 microgm.

FAHEY (J. E.). **Compatibility of copper fungicides with nicotine bentonite insecticides.**—*J. econ. Ent.*, xxxv, 4, pp. 517–520, 1942.

The effect of copper fungicides and nicotine-bentonite insecticides on the water-soluble nicotine and water-soluble copper contents of the water phase of spray mixtures prepared from these materials was studied in the laboratory of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture. The total copper percentage in 17 copper fungicides ranged from 6·5 to 56 per cent., the latter occurring in basic cupric carbonate, the corresponding figures for basic copper sulphate, red cuprous oxide, copper oxychloride, and copper phosphate being 50·8, 49·9, 48·2, and 45·3, respectively. Preliminary tests showed that a $\frac{1}{32}$–$\frac{1}{16}$–100 Bordeaux mixture exerts a measurable effect on the water-soluble nicotine content of the insecticides. Copper fungicides producing strongly alkaline spray mixtures (above P_H 8·5) above or in combination with nicotine-bentonite insecticides, will result in a large increase in the soluble nicotine content of the latter. The soluble copper content of the fungicides was increased by factory-processed and reduced by unaltered bentonite in the insecticides.

PARKER-RHODES (A. F.). **Studies on the mechanism of fungicidal action. IV. Mercury.**—*Ann. appl. Biol.*, xxix, 4, pp. 404–411, 1942.

The theory of variability, formulated in an earlier contribution to this series [*R.A.M.*, xxi, p. 422], was applied to dosage-mortality figures obtained for two fungi (*Macrosporium* [*Stemphylium*] *sarciniforme* and *Botrytis allii*) and one bacterium (*Bacillus agri*, derived from a culture obtained from the National Collection of Type Cultures in 1940) with a representative range of mercury compounds. From the estimates of the variability of the spores and cells to the various toxins used it is concluded that *S. sarciniforme* can absorb all the mercuric compounds tested, but requires the molecule of mercurous chloride to be dissociated to the metal and the mercuric salt before it can be absorbed; that *Botrytis allii* differs in being unable to absorb the methyl-mercuric ion in its native state; and that *Bacillus agri* cannot absorb mercury except in the form of its chloride, and possibly other combined forms which are produced under the influence of the diffusate from the cells. The term 'absorption' is here used as including adsorption as well as actual permeation. It is believed that in the present experiments the toxic effects against the bacterium were of bactericidal rather than bacteriostatic nature. Of all the compounds tested methylmercuric nitrate was the most toxic to the fungi (although the effect was less marked in the case of *Botrytis allii*) as well as to the bacterium.

GHESHELE (E. E.). Основы фитопатологической оценки в селекции. [The basis of phytopathological evaluation in selection.]—120 pp., 10 figs., 5 graphs, Госуд. Издат. колх.-совх. Литер. "Сельхозгиз" [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Moscow, 1941.

This text-book on plant breeding for resistance to disease is composed of eight chapters, the first three of which deal, respectively, with the biological specialization, the physiologic races of parasitic fungi, and the mechanism of infection and resistance in the host plant; and the remainder with the standards of comparative tests, methods of artificial infection, and criteria for the evaluation of results.

MÜHLE (E.). **Kartei für Pflanzenschutz und Schädlingsbekämpfung: 1. Lieferung, 1942, 42 Karteikarten.** [Chart for plant protection and pest control. Part 1, 1942, 42 chart cards.]—Leipzig, S. Hirtel, RM. 3.60. [Abs. in *Z. PflKrankh.*, lii, 9–10, pp. 455–456, 1942.]

The first part of this series of plant protection and pest control cards, of which 10 to

12 parts, comprising 400 to 500 pages, are planned for future publication, deals with the diseases and pests of the Gramineae, with special reference to fodder grasses. The aim of the work is to provide for each crop an identification table on the symptoms of the various disorders, cards for each pest and disease indicating the incidence, extent, effects, appearance, life-history, and control of the various pathogens; synopsis cards, supplying keys for the ready differentiation of closely related parasites and information on general matters of plant protection; and index cards to facilitate reference to individual pathogens under their various designations. From time to time a given card may be superseded by a new one incorporating the results of recent research.

Bryson (H. C.). **Fungal attack on glyptal resins.**—*Plastics*, v, 46, p. 43, 1 fig., 1941.

Fungal infection has been found to constitute an important cause of the breakdown of the glyptal resin (glycerine and phthalic anhydride) films widely used in the paint industry, the small, hard, black spots commonly observed on the surface being desiccated moulds. In the writer's experiments in England (Scott, Bader & Co., Ltd.), (*a*) six blocks of wood were varnished with a solution of glyptal resin (synolac S.B. 148), (*b*) six with synolac plus 0·33 per cent. of a 33 per cent. solution of zinc mercury naphthenate, (*c*) six with synolac plus 0·66 per cent. by weight of a 33 per cent. solution of zinc mercury naphthenate, and (*d*) six with synolac plus 3·3 per cent of a 33 per cent. solution of zinc mercury naphthenate. Synolac S.B. 148 is a linseed-tung oil-modified glycerolphthalic anhydride resin containing 48 per cent. combined fatty acid, the solvent being decalin and the drier 1·3 per cent. of a 50 per cent. solution in white spirit of a cobalt naphthenate. The four lots of samples were inoculated with a mixture of *Penicillium* and *Cladosporium* spores and incubated for five months at 18° to 30° C. Lot (*a*) contracted severe infection over the entire surface, (*b*) sustained only slight damage, (*c*) was barely touched, while (*d*) remained completely free from fungal invasion.

Turner (M. B.). **Mold problems of the paint industry.**—*Amer. Paint J.*, xxvi, 25, pp. 18–24, 1942. [Abs. in *Paint Tech.*, vii, 78, p. 96, 1942.]

The growth of unspecified moulds on paint is influenced by the physical characteristics of the film and the conditions of exposure, and identification may be difficult when the fungus occurs as a uniformly distributed spotting or in the form of individual colours. The requirements of fungicides for paints are discussed. Among the chemicals that have given promising results in laboratory tests are organic mercury compounds, organic and inorganic copper compounds, and chlorinated phenols, tetrachlorphenol being the most satisfactory [*R.A.M.*, xxi, p. 498]. It is soluble in paint oils and can either be incorporated with the pigment during grinding or dissolved in the thinners. Tetrachlorphenol possesses optimum water solubility both for fungicidal efficacy and film durability, and a 2 to 3 per cent. concentration prevents mould development under all conditions of exposure.

Mrak (E. M.), Phaff (H. J.), & Douglas (H. C.). **A sporulation stock medium for yeasts and other fungi.**—*Science*, N.S., xcvi, 2497, p. 432, 1942.

Good sporulation with several hundred yeast cultures belonging to 14 genera (including *Debaryomyces and Nematospora*) has been obtained in seven days or under on a medium made by grinding equal weights of washed, unpeeled carrot, beet, cucumber, and potato, and mixing with a quantity of water equal to the weight of the vegetables. The mixture was autoclaved at 10 lb. pressure for 10 minutes, after which the extract was separated from the solid part by the use of cheese-cloth and pressure. The P_H value of the extract was about 5·7 and the Balling degree about 4. Two per cent. agar was added, and slants were made. The sterilization advised is 15 lb. for 15 minutes. Certain other fungi also showed a strong tendency to produce conidia on this medium.

GRAINGER (MARY). **Some chemical aspects of the fungi.**—*Naturalist, Leeds*, 803, pp. 153, 158, 1942.

After presenting a table showing the presence or absence of the most usual constituents of other plants in a number of common fungi, the author discusses from a chemical standpoint the nature of the cell walls in fungi, the effect of seasonal factors on nitrogen nutrition, useful products obtained from fungi (e.g., penicillin), poisons produced by these organisms, and the value of fungi as food.

The edible fungi *Boletus edulis*, *Lactarius deliciosus*, *Claviceps purpurea*, and *Hygrophorus conicus*, with negative haemolytic and low nucleolytic activity, show a zinc content of 74, 86, 90, and 136·6 mg. per kg. dry matter, respectively, as against 167, 202, and 211 for the poisonous fungi *Amanita muscaria*, *A. pantherina*, and *Russula emetica*, respectively, which show a positive haemolytic and a high nucleolytic activity. From this it is concluded that the toxic properties of fungi, as shown by the ability to attack red blood corpuscles or cell nuclei, run parallel with a high zinc content. In this connexion it is pointed out that ergot, which is not too poisonous to be taken internally, is obtained from *C. purpurea*, the zinc content of which is nearer the range of the edible than of the poisonous fungi.

TOMLINSON (T. G.). **Some aspects of microbiology in the treatment of sewage.**—*J. Soc. chem. Ind., Lond.*, lxi, 4, pp. 53–58, 14 figs., 1 graph, 1942.

The following fungi occurring in experimental filters treating sewage by single and alternating double filtration at the Minworth works of the Birmingham Tame and Rea District Drainage Board are described: *Fusarium aqueductum*, the conidial stage of *Nectria episphaeria*, producing a conspicuous orange growth on the surface of sewage, milk factory, and beet sugar factory waste water-treating filters; a fungus provisionally identified by E. W. Mason, of the Imperial Mycological Institute, as an undescribed species of *Sepedonium*; *Oospora* spp., found only beneath the surface in association with the *Sepedonium*, except during the winter, when they form part of large fungal mats on the surface of the single filter; and a species of *Phoma* apparently initiating the fungal colonization of new filters, its pycnidia sometimes being visible as minute, black spots on the surface of the filtering medium. The *Sepedonium*, which is characterized by regular, branched, septate hyphae up to 16 μ in width, and spherical, brown, terminal, lateral, or intercalary chlamydospores, is perhaps the most important of the Minworth sewage moulds, its mycelium growing profusely on or below the filter surface during the colder months of the year.

An experiment is described in which it was found that on the surface of a double filter in the presence or absence of light, *F. aqueductum* was predominant under the former, and *Oospora* under the latter conditions. The *Fusarium* successfully competed in the light with *Stigeoclonium* and *Chlorella*, by which the *Oospora*, on the other hand, was overgrown. Apart from this competition, decomposition of fungal mycelium in the secondary filter was due to (*a*) starvation, and (*b*) bacterial invasion of the hyphae.

LEA (D. E.) & SMITH (K. M.). **The inactivation of plant viruses by radiations. II. The relation between inactivation dose and size of virus.**—*Parasitology*, xxxiv, 2, pp. 227–237, 3 graphs, 1942.

Continuing their investigations [*R.A.M.*, xx, p. 138] the authors describe further experiments on the inactivation of the viruses of tomato bushy stunt, tobacco necrosis, tobacco ring spot, tobacco mosaic, and potato virus X by gamma rays, X-rays, and alpha rays. The paper concludes with a hypothesis explaining the results obtained and correlating the inactivation dose with virus size.

LIHNELL (D.). **Coenococcum graniforme als Mykorrhizabildner von Waldbäumen.** [*Coenococcum graniforme* as a mycorrhiza-producer on forest trees.]—*Symb. bot. upsaliens.*, v, 2, 19 pp., 2 pl., 6 figs., 1942.

From four localities in Sweden and Denmark the writer collected the mycelium and sclerotia of *Coenococcum graniforme* [*R.A.M.*, xviii, p. 701]. The four isolates, which are morphologically closely similar, readily formed anastomoses in pure culture, a fact interpreted as an indication of near relationship. The fungus was shown by means of synthetic experiments to be capable of forming on *Pinus sylvestris*, spruce, birch (*Betula verrucosa*), aspen, and lime (*Tilia cordata*) mycorrhiza of the so-called 'Dn' type [ibid., xix, p. 423], characterized by their black colour, profusely radiating, coarse, black hyphae, and reticulate mantle. Negative results were given by tests on juniper, *Salix caprea* and *S. repens*, and alder (*Alnus glutinosa*), but there is some evidence to suggest that mycorrhizal production by *C. graniforme* on these species is not excluded under conditions other than those selected for these trials.

The appearance and mode of growth of the mycelium of *C. graniforme*, its tendency to produce mycorrhiza on various kinds of forest trees, and the similarity of these formations to those of *M*[*ycelium*] *r*[*adicis*] *nigrostrigosum* [loc. cit.] are considered to leave no doubt as to the identity of the two fungi. A basis for the discussion of the taxonomic status of *C. graniforme* may be afforded by the structural analogies between the hyphal mantles of the mycorrhiza in this species and the perithecial walls of the genus *Cephalotheca* (Plectascales).

MODESS (O.). **Zur Kenntnis der Mykorrhizabildner von Kiefer und Fichte.**—[A contribution to the knowledge of the mycorrhiza-producers of Pine and Spruce.]—*Symb. bot. upsaliens.*, v, 1, pp. 3–147, 3 pl., 1941. [Abs. in *Biol. Abstr.*, xvi, 8, p. 1865, 1942.]

This is an expanded version of the writer's studies of the synthesis between pine and spruce and pure cultures of 55 species of Gasteromycetes and Hymenomycetes, resulting in mycorrhizal formation, a preliminary note on which has already appeared [*R.A.M.*, xviii, p. 541]. *Pinus sylvestris*, *P. montana*, and *Picea abies* all formed mycorrhiza with *Amanita mappa*, *A. muscaria*, *A. pantherina*, *Boletus flavidus*, *Lactarius helvus*, *Tricholoma albobrunneum*, *T. imbricatum*, *T. pessundatum*, and *Scleroderma aurantium*. In addition, mycorrhiza were formed by *Pinus sylvestris* with *Entoloma rhodopolium*, *Paxillus prunulus*, *T. vaccinum*, *Rhizopogon luteolus*, and *R. roseolus*; and by *Pinus montana* with *R. roseolus*, *A. rubescens*, *B. subtomentosus*, and *L. rufus*. The hydrogen-ion relations of the mycorrhizal fungi were found to vary both in culture and in the field.

CRAIGIE (J. H.). **Heterothallism in the rust fungi and its significance.**—*Trans. roy. Soc. Can.*, 3rd Ser., xxxvi, Sect. v, pp. 19–40, 7 pl., 1942.

In this paper the author presents a comprehensive review of contributions to present knowledge of the rust fungi that have accumulated as a result of the discovery of heterothallism among these organisms. The points dealt with include experimental evidence of heterothallism, cytological investigations of heterothallism, the species that have so far been shown to be heterothallic, hybridization and progeny studies, intervarietal and interracial crosses, selfing, inheritance of pathogenicity and spore colour, and abnormalities resulting from inbreeding. A list of 79 references is appended.

ROBBINS (W. J.) & MA (ROBERTA). **Pimelic acid, biotin and certain fungi.**—*Science*, N.S., xcvi, 2496, pp. 406–407, 1942.

In experiments by the authors the addition of 0·05 μgm. of biotin to a tube containing 8 ml. of the basal medium permitted luxuriant growth of *Ceratostomella ips* No. 255, *C. ips* No. 438, *C. microspora*, *C. montium*, *C. obscura*, *C. penicillata*, *C. pini*, *C. radicicola*, *Grosmannia serpens* [*R.A.M.*, xv, p. 827], *Fusarium avenaceum*, *Neurospora*

sitophila 56·2, and *N. tetraspora* S, none of which made more than slight growth on a mineral-dextrose-asparagin medium without biotin. The synthesis of biotin by *Aspergillus niger* is said to be increased by the addition of pimelic acid to the medium, but the above-mentioned 12 fungi and *Nematospora gossypii* [ibid., xvii, p. 196], the organism used by Kögl as a means of bioassay in the original isolation of biotin, appeared under the experimental conditions to be unable to synthesize biotin from pimelic acid or from pimelic acid and *l*-cystine. The relation of micro-organisms to thiamin and its thiazole and pyrimidin intermediates have shown that some organisms have no synthetic power for thiamin, requiring it in molecular form; others have incomplete synthetic ability, and can construct the vitamin if given the requisite intermediates; while others, again, are able to make thiamin from the minerals and sugar in a basal medium. A similar situation may exist with regard to biotin, and if such is the case, the 13 fungi used in the authors' experiments would seem to require biotin as such.

Cowie (G. A.). **Factors inducing mineral-deficiency symptoms on the Potato plant.**—*Ann. appl. Biol.*, xxix, 4, pp. 333–340, 1 fig., 1942.

The following results were obtained in 24 replicated manurial trials made on the potato crop (mainly the Majestic variety) in widely spread localities from the north of Scotland to the south of England in 1937 and in 25 further trials of a different design in 1938. Leaf scorch and other typical potash deficiency symptoms on the aerial parts of potato plants were normally induced by treatment with nitrogen plus phosphate and not by nitrogen only, and the presence of leaf scorch on nitrogen plots was found to be correlated with a high level of available phosphates in the soil. An increase in the level of nitrogen in the nitrogen-phosphate treatment resulted in intensified potash-deficiency symptoms. It is concluded that some interaction between nitrogen and phosphates is the primary factor responsible for inducing potash-deficiency symptoms in the above-ground parts of potato plants. The blackening of cooked tubers [*R.A.M.*, xxi, p. 41] is believed to be due to a combination of high nitrogen with low potash levels in the soil. Phosphate-deficiency symptoms were induced by nitrogen, and, even more strongly, by nitrogen-potash treatments. Under conditions of low phosphates and low potash in the soil the nitrogen plants exhibited phosphate-deficiency and not potash-deficiency symptoms. Foliar symptoms of calcium deficiency were observed in three localities on poor sandy soils with P_H values below 5. No symptoms of magnesia deficiency were present in any locality and season, and there were no significant yield responses to magnesia with one exception in each year.

Sheffield (F[rances] M. L.). **The 'blotches' on leaves of Arran Pilot Potatoes.**—*Ann. appl. Biol.*, xxix, 4, pp. 341–345, 2 pl., 1942.

The nature of the grey-green blotches or blisters sometimes observed at flowering time on leaves of the popular early potato variety Arran Pilot and occurring with varying degree of intensity from district to district and from season to season, although usually more intense in the west and north, was studied during 1941 at Harpenden. The blotches were found to be due to necrosis of the epidermis, followed by cell division in the palisade tissue to form several layers of small, thin-walled, colourless cells. This proliferation may occur on the top only or on both sides of the leaf, the new tissue partially masking the green of the older cells underneath. Soon after the blotches become visible externally, the tissues within them begin to degenerate and completely dry out after three to four weeks. The exact nature of the disorder, which is believed to be of genetic origin, has not been established.

Dykstra (T. P.). **Compilation of results in control of Potato ring rot in 1941.**—*Amer. Potato J.*, xix, 9, pp. 175–196, 1942.

This is the report of the 1941 survey of the committee appointed by the American

Potato Association for the stimulation and co-ordination of research on ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*] already noticed in part from another source [*R.A.M.*, xxi, p. 502].

Tests at the Wyoming Agricultural Experiment Station to ascertain the most reliable method of inoculation indicated that the introduction of an agar culture suspension through the sprouts with a hypodermic needle expedited the development of the symptoms, while the immersion of whole tubers in a bacterial suspension resulted in a later appearance and lower incidence of infection than in any of the other tests. The use of a contaminated cutting knife induced 100 per cent. infection by 4th September (tubers planted on 21st May), the corresponding figures for smearing on the cut surface with a diseased tuber, dipping cut and whole tubers in a bacterial suspension, and the hypodermic needle insertion being 98·3, 91·7, 70, and 97 per cent., respectively. At Beltsville, Maryland, the highest percentage of infection was obtained by the immersion of the cut surface in a bacterial suspension for 15 minutes, followed by immediate planting, and none by the hypodermic injection of a suspension of *C. sepedonicum* into shoots 8 to 10 in. high: satisfactory results were further secured by hypodermic inoculations 2 mm. from the 'eyes' of the seed pieces but not by dipping whole tubers in a suspension of the pathogen. The effect of different concentrations of the bacterial suspension in hypodermic inoculations through the 'eyes' was tested, using 40 plants in each of three series of which A was diluted with 5 c.c. water per agar slant, B with 10, and C with 20. The percentages of stalk and tuber infection in A, B, and C amounted to 45·6 and 1·7, 72 and 8·3, and 31·5 and 0, respectively.

In Wyoming no difference in the symptoms developing in plants inoculated by various methods with *C. sepedonicum* from eight different States could be detected. The average infection from 18- to 20-day-old cultures was 56 per cent. compared with only 12 per cent. from 40-day-old cultures. The application of smears from diseased tubers to the cut surfaces and needle-stab inoculations through the 'eyes' gave 100 per cent. infection.

At Beltsville a modified potato dextrose medium was found to be the most suitable for the growth of *C. sepedonicum*; it consists of 300 gm. pared and sliced potatoes, 12 gm. agar, 5 gm. peptone, 6 gm. dextrose, and 1 gm. yeast extract in 1,000 c.c. water (P_H 6·8 by 6·9).

Little difference was observed at Beltsville between pure cultures of *C. sepedonicum* and those contaminated by certain soft-rotting organisms in respect of the incidence of stalk infection, but the admixture of *Bacillus subtilis*, a green-fluorescent bacterium, and No. 31 resulted in 65·2, 20·6, and 44·4 per cent. tuber infection, respectively, compared with 1·7 per cent. induced by *C. sepedonicum* alone.

At the same station the spread of infection in the vascular bundles of hypodermically inoculated tubers was found to range from 5 to 10 mm. after two months, while after three, positive readings were obtained at 1 and 2 cm. from the needle track in 67 and 23 per cent. of the tubers, respectively. Six weeks after planting seed pieces contaminated by a suspension of *C. sepedonicum* ten minutes earlier, all the shoots had contracted infection, the distance of the organism from the point of inoculation ranging from 1 to 14 cm.

Inoculation experiments in West Virginia in 1940 yielded apparently negative results, but in 1941 up to 57 per cent. infected hills developed from the apparently sound tubers, the importance of this observation lying in the latent presence in seed stock which would have passed all certification requirements of a very high percentage of potential infection.

Neither in Florida nor in Michigan could any indication be obtained of a spread of ring rot from hill to hill or row to row. In a test in the former State in which healthy seed was cut with a contaminated knife, the incidence of infection developing in lots planted immediately and stored in a jute bag for 36 hours amounted to 9·2 and 23 per cent., respectively. In another test, one half each of 148 diseased tubers was planted

immediately after cutting and the other stored as above for 24 hours, the percentages of infection in this instance being 10 and 31, respectively.

In Wyoming the ring-rot organism was found to survive the winter on contaminated sacks left outdoors and kept in a storage cellar, on tubers in outside soil, and the soil surrounding diseased tubers out-of-doors, producing 45, 10, 2·5, and 2·5 per cent. infection, respectively, on healthy seed pieces, but in Florida and Canada negative results were given by overwintering tests. In tests under controlled conditions in Minnesota *C. sepedonicum* persisted for less than a month in non-sterile soil except at temperatures at or near freezing point, which confer some degree of protection.

In date-of-planting experiments in Wyoming the incidence of ring rot in inoculated stands planted on 11th and 21st May and 1st and 11th June amounted to 40·3, 98·7, 90·8, and 100 per cent., respectively, the periods elapsing in each case between planting and first symptom appearance being 88, 67, 63, and 59 days, respectively.

As in previous trials, mercuric chloride, acidulated mercuric chloride, and iodine were the most effective disinfectants for cutting knives, while promising results were also secured by 5-, 10-, and 15-second exposures to boiling water. Injury to the seed pieces from these treatments varied in different States from serious to negligible. Mercuric chloride (1 in 500) was highly effective in the prevention of the spread of ring rot from diseased to healthy seed pieces while other satisfactory preparations for this purpose were acidulated mercuric chloride and cinnex special (containing yellow oxide of mercury and 1 per cent. iodine). As in the case of the cutting knife treatments injury to the seed pieces from these methods of disinfection was very variable in extent. In tests in Wyoming on the relative efficacy of various chemicals as storage-cellar disinfectants, B–K, 2,000 p.p.m., steri-chlor, 500 and 1,000 p.p.m., formaldehyde 1 in 120, and copper sulphate 1 in 50, sprayed on contaminated boards, gave good control of ring rot.

Extensive greenhouse tests in Montana on Netted Gem stocks yielded further evidence in favour of the ultra-violet light method, operated under proper conditions, for the detection of ring rot-diseased tubers. In trials with fluorescent light in Colorado the results obtained at 40° F. were more satisfactory than at 70°.

Burkholder (W. H.). **Diagnosis of the bacterial ring rot of the Potato.**—*Amer. Potato J.*, xix, 10, pp. 208–212, 1942.

This is a discussion of the various laboratory procedures advocated for the specific determination of potato ring rot (*Corynebacterium sepedonicum*) or as aids in its diagnosis [see preceding abstract]. The writer's own view, corroborated by the experience of J. B. Skaptason in New York State, is that in the majority of cases the disease is recognizable by an expert on the basis of its symptoms in the living plants: where any doubt as to the identity of the pathogen arises, the ultra-violet light or Gram-stain methods of identification should be applied.

Koehnke (M.) & Shaughnessy (J.). **Nebraska seed improvement program for Nebraska Potatoes.**—*Amer. Potato J.*, xix, 8, pp. 161–166, 1 diag., 1942.

Potato seed stock improvement was initiated in Nebraska by H. C. Werner [*R.A.M.*, ix, p. 263] in 1923, since when the work has proceeded without interruption, having been taken over in 1936 by the Nebraska Certified Potato Growers. The seed farm acreage has increased from between 5 and 15 acres in 1924 to 125 at the present time (150 in 1939). Two methods of indexing are used, one for individual tubers under controlled greenhouse conditions, and the other for separate hills in Alabama, where numbered lots are grown from January to April, two small tubers from each hill being sent away and the rest stored at 38°. In the greenhouse at 70° to 75° F. seed pieces are removed from the numbered tubers, treated with ethylene chlorhydrine to break the rest period after suberization, and planted in an electrically heated germinating

bench filled with peat moss, and on attaining a height of 1 to 2 in. the sprouts are transplanted into soil benches (65° to 70°). The corresponding tubers are meanwhile placed in cold storage. When the greenhouse plants reach a height of 6 to 8 in., any diseased or weak plants and their corresponding tubers are eliminated, the healthy tubers then being grouped together in strains or varieties. In the second method, according to information received from Alabama, the hills producing tubers which gave rise to healthy plants are retained, and those resulting in diseased or otherwise undesirable material discarded.

In the spring the healthy material is planted out by the tuber unit method in isolated fields, and roguing, especially for spindle tuber and mosaic, is performed four to six times during the summer. All the seed is harvested and stored until the following spring, when it is again tuber unit-planted and rogued regularly. In the autumn it is harvested and released to growers, under satisfactory guarantees, to serve as the source of seed for their certified acreage during the following year.

Throughout the many steps involved in the seed improvement programme, stringent precautions are taken to exclude contamination by ring rot [*Corynebacterium sepedonicum*: see preceding abstracts], all equipment being treated with H T H solution before and after handling each lot of potatoes, the storage space disinfected with copper sulphate, and new sacks used for the movement of all seed form tubers.

Clonal lines are propagated from separately harvested units of each strain, all but one of the original selections (numbering several hundreds) being gradually discarded and the chosen unit becoming the source of continued production.

Folsom (D.). **Tuber-line seed plots.**—*Amer. Potato J.*, xix, 1, pp. 225–229, 1942.

From 1933 to 1938, 114 tuber-line seed plots were laid down on 74 farms in Maine, followed in each case during the next year by an inspection to determine the nature and extent of the movement of potato viruses into the seed stocks [*R.A.M.*, xxi, p. 499]. The results of the experiment indicated that the practice of tuber-unit planting, though helpful, did not by itself suffice for the development of mosaic- and leaf roll-free stocks, the likelihood of infection by, or freedom from, these viruses being about equal. The control of both diseases was promoted by earliness and large size of the plots, while mosaic was less prevalent outside the north-eastern region of the State and in isolated situations, leaf roll, on the contrary, being less in evidence in the north-east than elsewhere.

Meyer (G.). **Zellphysiologische und anatomische Untersuchungen über die Reaktion der Kartoffelknolle auf den Angriff der Phytophthora infestans bei Sorten verschiedener Resistenz.** [Cyto-physiological and anatomical studies on the reaction of the Potato tuber to the attack of *Phytophthora infestans* among varieties of differing resistance.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, 23, pp. 97–132, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 1, p. 52, 1943.]

A full account is given of the mycelial development in the group A strains of *Phytophthora infestans* on the cut tubers of late blight-susceptible commercial potato varieties and of the W races, and of the resultant changes taking place in the tuber [*R.A.M.*, xix, p. 490; xxi, p. 501]. The W races, all of which are resistant in the foliage, varied in tuber reaction to the fungus. The resistant races were the first to respond to attack by the pathogen, and their reactions proceeded much more rapidly throughout than those of the more susceptible strains; in other respects the behaviour of the resistant and susceptible races was similar, except that in the former no wound periderm between the necrotic and surrounding tissues was observed, neither did any fructifications of *P. infestans* develop. Another feature of the attack on the resistant tubers was their early positive reaction to tannin-detecting agents.

HOLMBERG (C.). **Potatiskräfta och Potatisål i Sverige under 1941.** [Potato wart and Potato eelworm in Sweden in 1941.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vi, 1, pp. 6–8, 1942.

During 1941, 33 new cases of potato wart [*Synchytrium endobioticum*] were registered in Sweden, 14 of which occurred in localities hitherto unaffected by the disease [*R.A.M.*, xx, p. 157]. The number of fresh foci of infection is stated to be exceptionally low in comparison with the figures for previous years.

THATCHER (F. S.). **A stem-end rot of Potato tubers caused by Rhizoctonia solani.**—*Phytopathology*, xxxii, 8, pp. 727–730, 2 figs., 1942.

Rhizoctonia [*Corticium*] *solani* was isolated from potato tubers affected by a 'punky' or 'cheesy' stem-end decay in Prince Edward Island, and its pathogenicity experimentally demonstrated. Infection apparently originated at the stolon scar and thence extended radially through the parenchyma tissue for a distance of 1 to 3 cm., finally becoming evident as a dark necrosis with a sharply defined margin, just beyond which copious phellogen formation wholly or partially restricts the further progress of the fungus; where the barrier is not completely effective, another phellogen layer is produced to check the advance of the secondary necrotic zone. In the specimens examined the necrotic cells of the earlier invaded tissues had undergone such widespread disintegration that the contents consisted of little but a mass of starch grains.

The fungus is believed to have entered the tubers through the tracheids in the vascular bundles leading from the stolon scar, in the lumina of which many hyphae were present; these escaped at intervals along the path of the bundle by way of the pits into the parenchyma cells, causing typical degeneration. The prevalence of very wet and cool conditions just before harvest prevented the complete occlusion of the ends of the vascular bundles leading from the stolon by delaying the formation of the wound periderm at the scar, thereby permitting the migration of the hyphae into the tissues during the continuance of the unfavourable weather.

Typical stem-rot symptoms developed in Green Mountain tubers inoculated with mycelium from a potato-dextrose agar culture of *C. solani* held at 5° C. in a moist chamber and in very wet sand at 15° to 20°, establishing the capacity of the fungus to produce decay unless impeded by rapid wound periderm formation.

KÖHLER (E.). **Die Ueberempfindlichkeitsreaktion bei Solanum nodiflorum Jacq. gegenüber Stämmen des Tabakmosaik und des Kartoffel-X-Virus.** [The hypersensitivity reaction in *Solanum nodiflorum* Jacq. towards strains of the Tobacco mosaic and Potato X-virus.]—*Z. PflKrankh.*, lii, 9–10, pp. 450–454, 2 figs., 1942.

The author's previous experiments with the virus of acronecrosis on potatoes [*R.A.M.* xvi, p. 707] and with that of tobacco ring spot on beans (*Phaseolus vulgaris*) and chilli (*Capsicum annuum*) [ibid., xx, p. 422] showed that hypersensitivity on the part of the respective hosts to the viruses in question is associated with the production of toxins by the latter. In the series of tests herein described, *Solanum nodiflorum* plants, 35 cm. in height, were inoculated on 11th June 1941 by leaf-rubbing with the juice from Samsun tobacco of five strains of the X-virus of potatoes, viz., Mb 12, CsA, Cs37, Bf, and Us (all belonging to the X^N group except Bf, a derivative of X^E), and four of that of tobacco mosaic, namely, TM/S, TM/w, G2, and G7, four plants being used for each virus.

The following observations were made a week later. No symptoms (latent infection) were induced by Mb 12, CsA, TM/S, TM/w, or G2; Cs37 caused the formation of numerous inconspicuous, yellowish lesions with small, necrotic circles or spots in their centres; a similar but milder spotting followed inoculation with Bf; Us and G7 were both responsible for the development of many bluish-green, circular spots, with necrotic dots and areas in their centres, against a yellow-discoloured background. The interest of these data lies in two viruse strains, Us and G7, belonging to different classes giving

of toxic proteins, which are presumably, judging by the agreement of the responses evoked, constitutionally identical. Both the strains under observation arose on Samsun tobacco as spontaneous mutants from 'normal' strains of their respective parent viruses. Hence it would appear that the strains of different viruses are capable of acquiring certain identical radicals, the choice of which may be conditioned by the substratum.

A repetition of the experiments during the following winter gave negative results, confirming previous observations as to the decisive influence on the outcome of inoculation of the physiological condition of the host or the particular leaves infected.

Kuilman (L. W.). **Wortelstudien aan tropische landbouwgewassen. I. Wortelontwikkeling en vruchtbaarheid.** [Root studies on tropical agricultural crops. I. Root development and fertility.]—*Landbouw*, xvii, pp. 673-690, 1941. [Abs. in *Plant Breed. Abstr.*, xiii, 1, p. 46, 1943.]

'Mentek' [root rot], a rice disease probably attributable to potassium deficiency, is stated to be less prevalent than formerly in the Dutch East Indies [*R.A.M.*, ix, p. 161; x, p. 298, *et passim*], possibly owing to the extended use of the resistant varieties developed at the Institute of Agronomy (Cultuurtechnische Instituut). In two instances the highly susceptible Temas variety proved quite resistant to root rot when planted at the rate of 15 plants instead of one per hole. Resistance appears to be correlated with a well-developed, dense root system with numerous very fine root fibres, such as characterizes the Poeloet Nangka, Gading Kloeang, and Moering varieties, which showed little or no trace of potassium deficiency even in trials on soil with a low content of this element, indicating that their abundance of fibrous rootlets facilitates the intensive utilization by the resistant sorts of soil minerals. A survey of varieties graded according to the type of root system showed that among the resistant rice varieties are many widely cultivated for their prolific yields, e.g., Oentoeng and Tjina.

Martin (T. L.) & Graham (R. C.). **Influence of organic matter decomposition on the fungus flora of the soil.**—Abs. in *Proc. Utah. Acad. Sci.*, xviii, pp. 11–12, 1941.

The soil organisms responsible for the decomposition of organic matter utilize the soluble materials first, hence the percentage of insoluble matter increases with time. Previous experiments have shown that both the quantity and quality of soil fungi undergo extensive changes corresponding to these chemical processes, *Mucor* and *Rhizopus* spp. developing most profusely during the first few weeks and being succeeded in turn by *Penicillium* and *Aspergillus* spp., and ultimately, towards the close of the decomposition period, when resistant materials predominate, by dark-coloured moulds, such as *Cladosporium* and *Trichoderma* [including *C. herbarum* and *T. viride*].

In experiments at Provo, Utah, the influence of sweet clover [*Melilotus*], lucerne, Russian thistle [*Salsola kali*], white top beets and roots, and straw on the fungal population of the soil was studied, 2 per cent. of each material being incorporated and the specimens kept at the optimum moisture content for eight weeks, during which they were sampled weekly. The results confirmed those obtained in former trials. The *Mucor* and *Rhizopus* spp., after vigorous initial growth, gradually ceased to develop and had disappeared by the sixth week; the incidence of *Penicillium* and *Aspergillus* spp., which rose as that of the Mucorales declined, began to decrease about the fifth week and were replaced by *Cladosporium* and *Trichoderma*, which continued to multiply until the end of the trials. The only difference between the effects of the various materials tested was the somewhat more rapid action of the legumes on the microbial sequence.

Tavernetti (J. R.). **A continuous soil pasteurizer.**—*Agric. Engng, St. Joseph, Mich.*, xxiii, 8, pp. 255–256, 261, 1 fig., 1 diag., 1 graph, 1942.

A tabulated account is given of experiments conducted at the University of California to determine the utility of a continuous soil pasteurizer with a 4-in. belt conveyor of the type constructed and tested in New York and described by Newhall

[*R.A.M.*, xv, p. 824]. The average rate of pasteurizing was approximately 5 cu. ft. of loose soil per hour or 1 cu. ft. per 1,000 w. of heating capacity, the most favourable moisture content for the soil ranging from 3 or 4 per cent. with pure sand to as much as 25 or 30 per cent. in the case of loam, peat, leaf mould or mixtures of these. The electric energy consumption averaged about 1 kw.-hr. per cu. ft. soil. Damping-off (*Pythium*) of sugar beet seedlings and *Rhizoctonia* [*Corticium solani*] on Whippoorwill cowpeas were controlled by heating the soil to 150° F. or above.

WHETSTONE (R. R.), ROBINSON (W. O.), & BYERS (H. G.). **Boron distribution in soils and related data.**—*Tech. Bull. U.S. Dep. Agric.* 797, 32 pp., 1 fig., 1942.

A systematic survey of the boron status of soils throughout the United States showed that three large areas are likely to suffer from boron deficiency: Atlantic and Gulf coasts from Maine to Texas; northern Minnesota, Wisconsin, and Michigan; and California and the Pacific Northwestern States. Natural boron toxicity is believed to be unlikely to occur except in arid regions; and toxicity from added boron more likely in acid, sandy soils, often previously deficient in boron. Injury to apples, alfalfa [lucerne], celery, and beets resulting from boron deficiency in Oregon, West Virginia, and North Carolina was found associated with low boron content of the soil. The high boron content of lucerne stems and leaves from Raft River, Idaho (69 p.p.m.) suggests that 'yellows' there is not due to boron deficiency but to some other cause.

RANGASWAMI (M. S.). **Progress report of the forest administration in Coorg for 1940–41.**—Bangalore, Mysore Residency Press, 49 pp., 1942.

The following item of phytopathological interest occurs in this report (p. 5). During the period under review, the incidence of spike on sandal [*Santalum album*] increased in zones already affected by the disease and developed sporadically in regions hitherto free from it. After lopping and burning the leaves and twigs, all the spiked trees were treated with sodium arsenite and uprooted [*R.A.M.*, xviii, pp. 138, 818].

BOSE (A. B.). **Alternaria on leaves of Sunflower in India.**—*J. Indian bot. Soc.*, xxi, 3–4, pp. 179–184, 1942.

From shrivelled sunflower leaves bearing small, oval, often depressed, whitish spots at the Carmichael Medical College, Calcutta, the writer isolated *Alternaria tenuis* in pure culture on 3 per cent. malt agar and Brown's synthetic medium, the identification having been confirmed by G. W. Padwick and M. Mitra. The pathogenicity of the fungus was established by inoculation experiments with conidial suspensions on wounded and unwounded leaves.

MOURASHKINSKY (K. E.). Защита Подсолнечника от болезней в восточных районах [Control of diseases of Sunflower in the eastern districts].—*Ex* К весеннему севу 1942 года. Сборник статей. [On the occasion of spring sowing in 1942. Collection of papers.], pp. 37–39, Издат. Наркомзема СССР [Publ. Off. People's Comm. Agric. U.S.S.R.], Omsk., 1942.

The three diseases mainly responsible for crop losses of sunflower in Siberia are stated to be white rot (*Sclerotinia*) [*S. sclerotiorum*: *R.A.M.*, xii, p. 571], generally prevalent in the more northern districts and in the southern only in wet seasons; *Verticillium* disease [*V. dahliae*: loc. cit.], particularly destructive in southern districts in dry seasons; and rust [*Puccinia helianthi*: loc. cit. and ibid., xvi, p. 539], described as less serious than in European Russia, probably owing to the less favourable climatic conditions obtaining in Siberia. The amount of infection caused by either of these three fungi varies greatly from year to year and from district to district. The yearly losses in crop due to all diseases are stated to amount on the average to about 20 per cent., but it is considered possible to reduce these losses drastically by seed disinfection, early sowing, thorough weeding, removing and burying or burning plants showing the first symptoms of disease, as well as stalks left in the field after harvesting, deep ploughing in spring and autumn, and by adopting a triennial rotation.

KEYWORTH (W. G.). **Verticillium wilt of the Hop (Humulus lupulus).**—*Ann. appl. Biol.*, xxix, 4, pp. 346–357, 1 pl., 2 figs., 1942.

The author's investigations into the wilt disease of hop, caused by *Verticillium albo-atrum* or, more rarely, by *V. dahliae*, were continued from 1938 to 1941 and confirmed largely the conclusions previously reached [*R.A.M.*, xviii, p. 709; xix, p. 364]. The results of three field experiments failed to show a relation between occurrence of wilt and local variations in soil moisture conditions. Soil disinfection with 2 per cent. formalin at the rate of 8 gals. per sq. yd. gave promising results. Diseased leaves and bines and infected cuttings for planting were again found to be important means of spreading the disease. In addition to general hygienic measures aimed principally at removing sources of infection which had been previously recommended for the control of the disease in the fluctuating and the progressive type of attack, it is advised in the case of small first outbreaks to cut down and burn all the bines of the diseased plants and of adjacent healthy ones, then to remove the soil (1 yd. square and 1 yd. deep) from the cleared site of each plant, pour 8 gals. of 2 per cent. formalin into each hole, fill the holes up with uninfected soil, and finally to treat the whole area from which the plants have been removed with 2 per cent. formalin at the rate of 8 gals. per sq. yd. Such areas can be replanted after three to four weeks, but should be closely watched for wilt during the following season.

WIEHE (P. O.). **La sensibilité de quelques variétés de Cannes aux principales maladies existant à Maurice.** [The susceptibility of certain Cane varieties to the principal diseases occurring in Mauritius.]—*Rev. agric. Maurice*, xxi, 5, pp. 225–226, 1942.

A table is given showing the reactions of 32 sugar-cane varieties cultivated in Mauritius to the seven principal diseases affecting the crop in the island, namely (in descending order of importance), gummosis (*Bacterium* [*Xanthomonas*] *vasculorum*), leaf scald (*Bact. albilineans*), red rot (*Colletotrichum falcatum*), root rot (*Pythium* and *Rhizoctonia* spp. in conjunction with eelworms), smut (*Ustilago scitaminea*), chlorotic streak, and eye spot (*Helminthosporium sacchari*).

THIND (K. S.). **The genus Peronospora in the Punjab.**—*J. Indian bot. Soc.*, xxi, 3–4, pp. 197–215, 1 col. pl., 16 figs., 1942.

Included in this taxonomic survey of 16 species of *Peronospora* [*R.A.M.*, iii, p. 241] collected on 20 hosts in India from January to April, 1940, are six new fungus and seven new host records for the country, among which may be mentioned *P. viciae-sativae* on vetch, *P. lathyri-palustris* on *Lathyrus sativus*, *P. trigonellae* on *Trigonella foenum-graecum*, *P. aestivalis* on lucerne and *Medicago denticulata* (an aggressive parasite on the former), *P. trifolii-repentis* on *Trifolium resupinatum*, *P. arborescens* on *Papaver rhoeas* [ibid., xxi, p. 99], and *P. brassicae* on cabbage, turnip, radish, and *Malcolmia africana* (apparently the first report of the mildew on this host).

Discussing the nomenclature of the *Peronospora* on *Chenopodium album*, the writer draws attention to its reference to *P. effusa* by Butler and Bisby [ibid., xi, p. 545] and to *P. variabilis* Gäumann by Mundkur [ibid., xviii, p. 57]. Actually the host is liable to infection by both species, the differences between which are shown in tabular form.

Dutch Elm disease quarantine. Revision of quarantine and regulations effective October 1, 1941.—U.S.D.A., B.E.P.Q., 4 pp., 1942.

As from 1st October 1941 the 'regulated areas' for the purpose of Dutch elm disease (*Ceratostomella ulmi*) control are extended to include parts of nine counties of Pennsylvania and additional sections of Connecticut, New Jersey, and New York in which the fungus has been located [*R.A.M.*, xix, p. 128]. The regulations prohibit inter-State movement from the regulated areas to any area outside their radius of all parts of elms of all species, with the exception of elm timber or products manufactured from or containing elm wood, if entirely free from bark.

IMPERIAL MYCOLOGICAL INSTITUTE

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It is with very deep regret we have to record the death from influenza on April 4th, 1943, of Sir Edwin John Butler, C.M.G., C.I.E., F.R.S., Director of the Imperial Mycological Institute from 1920 to 1935.

TEHON (L. R.). **Can we reproduce Saccardo's Sylloge Fungorum?**—*Mycologia*, xxxiv, 5, pp. 592–593, 1942.

The author invites the opinion of mycologists on the proposed reproduction of Saccardo's Sylloge Fungorum, which can be made available in complete sets at the very moderate cost of about $30 to $40 each, provided as few as 50 advance subscriptions are obtained. The process of reproduction, known as the Readex Microprint, furnishes actual printed pages of a much reduced size. For the reading of these, a special patented apparatus (present price $225.00) is required, which throws the reproduced page on to a glass screen at a convenient reading distance and at a normal page size. It is suggested that the reading apparatus with its powerful surface illumination and magnification of about 10 to 16 diameters would be generally useful in research laboratories and for teaching, while its price, added to that of the reproduction, still constitutes only a small fraction of the cost of an original copy of the Sylloge, if such were available. The writer would appreciate assurances that individuals or institutions would subscribe for a microprint set of the Sylloge.

HONEY (E. E.). **Monilinia amelanchieris.**—*Mycologia*, xxxiv, 5, pp. 575–578, 1942.

The author fully describes the perfect and the conidial stages of the fungus originally collected by Reade in 1907 near Ithaca, New York State, and later observed by the author in the same locality on *Amelanchier intermedia* and other *A.* species, under the names of *Monilinia amelanchieris* and *Monilia amelanchieris*, respectively. A more extended paper on this study is being prepared for publication.

SEAVER (F. J.) & WATERSTON (J. M.). **Contributions to the mycoflora of Bermuda—III.**—*Mycologia*, xxxiv, 5, pp. 515–524, 3 figs., 1942.

This annotated list of 25 fungi collected in Bermuda during 1940 includes two new species. *Sclerotinia sclerotiorum* was found for the first time locally on banana, the only previous record on this host being that by Reichert and Hellinger from Palestine [*R.A.M.*, x, p. 117]. *Botryosphaeria ribis* is recorded on cassava, apparently a new host for this fungus. Inoculation experiments proved *B. ribis* to be weakly parasitic. *Diplodia* [*Botryodiplodia*] *theobromae* was found responsible for considerable wastage to tubers of cassava, entering the plants through cracks caused by wind.

WHIFFEN (ALMA J.). **A discussion of some species of Olpidiopsis and Pseudolpidium.**—*Amer. J. Bot.*, xxix, 8, pp. 607–611, 27 figs., 1942.

By using boiled grass leaves as a bait for Chytrids in soil and water collections a

number of species of *Pythium*, one of *Aphanomyces*, and parasites of these were obtained.

A study of *Pseudolpidium gracile*, parasitic on *Pythium rostratum*, found in a soil collection in Florida confirmed Butler's observation (*Mem. Dep. Agric. India*, Bot. Ser., i, 5, pp. 1–160, 1907) that the resting body had no companion cell. *Olpidiopsis aphanomycis* Cornu, parasitic in *Aphanomyces cladogamus* from soil near Petahatche, Mississippi, also formed resting bodies lacking in companion cells. Diagnoses are given of *O. curvispinosa* n.sp. and *O. brevispinosa* n.sp. parasitic on two different species of *Pythium*, in North Carolina and Louisiana, respectively. It was not found possible to transfer any of these species of *Olpidiopsis* from the host on which it had been collected to that of any other of these four species.

WHIFFEN (ALMA J.). **Two new Chytrid genera.**—*Mycologia*, xxxiv, 5, pp. 543–557, 52 figs., 1942.

The author establishes two new genera, *Solutoparies* and *Septosperma*, belonging to the Rhizidiaceae. The type species of the former, *Solutoparies pythii*, is described as an exoparasite of an undetermined *Pythium* sp., isolated in 1940 from soil at Chapel Hill, North Carolina.

Indian Tea Association. Scientific Department. Annual Report—1941.—10 pp., 1942.

Various treatments were applied at the Tocklai Experimental Station for the control of branch cankers of tea, which in north-east India are usually due to sun scorch [cf. *R.A.M.*, xv, p. 780]. Fitting thatched shade over the bushes to exclude sun from the branches resulted in a reduction of 68 per cent. in the incidence of the disorder, the corresponding figures for whitewashing all branches exposed to the southern and western sun, and replacing all branches cut off in the medium pruning on the top of the bush, being 65 and 30 per cent., respectively, and for a combination of all three methods, 80 per cent. High-yielding bushes were found to be more liable to sun scorch than unproductive ones. In another test, in which half the bushes medium-pruned in September were shaded by *Boga medeloa* and the other half left unprotected, the latter were severely scorched in November, while the former were scarcely affected. Pruning in September and October resulted in a much higher incidence of sun scorch than the same operation in November, December, and January, the numbers of bushes affected (out of 540 in each instance) in the five months being 228, 247, 28, 42, and 47, respectively.

DIACHUN (S.), VALLEAU (W. D.), & JOHNSON (E. M.). **Entrance of non-motile bacteria and chemicals into water-soaked Tobacco leaves.**—Abs. in *J. Bact.*, xliv, 3, pp. 387–388, 1942.

In tests conducted at the Kentucky Agricultural Experiment Station to determine whether the leaf-spotting bacteria of tobacco [*Pseudomonas tabaca* and *P. angulata*] enter the foliage of their host by means of their own motility, or are carried in by the action of some external force [*R.A.M.*, xxi, p. 540], non-motile organisms (*Staphylococcus aureus*) were placed on water-soaked and normal tissues of the same leaf. On the disappearance (within half an hour) of the water-soaking, the leaf surface was sterilized with mercuric chloride and excised, macerated fragments mixed with agar in Petri dishes. Within a few days thousands of colonies of *S. aureus* developed on each plate prepared from water-soaked tissues, whereas none grew on the controls. Swimming is therefore unnecessary for the bacterial invasion of foliage. The water-soaked tissues were further penetrated by India ink, inducing an ineradicable blackening, and by mercuric chloride, copper sulphate, and Bordeaux mixture, which resulted in necrosis. These observations suggest the intervention of naturally induced water-soaking in the causation of spray injury.

Anderson (P. J.). **Control of blue mold of Tobacco by a new spray.**—*Science*, N.S., xcvi, 2496, p. 409, 1942.

The information given in this paper on the successful control of *Peronospora tabacina* by ferric dimethyl dithiocarbamate ('fermate') has already been noticed from another source [*R.A.M.*, xxi, p. 506].

Clayton (E. E.). **Fungicidal value of the salicylates.**—*Science*, N.S., xcvi, 2494, p. 366, 1942.

The problem of finding substitutes for copper fungicides, particularly for the control of the downy mildews, is becoming increasingly important. In fungicide tests conducted over a period of ten years by the Bureau of Plant Industry, United States Department of Agriculture, in co-operation with the experiment stations of Georgia, South and North Carolina, and Maryland, the best control of tobacco downy mildew [*Peronospora tabacina*: see preceding abstract] was obtained with bismuth subsalicylate used at the rate of $1\frac{1}{2}$ lb. plus 1 lb. of vatsol O.T.C. (sodium dioctyl sulphosuccinate) [*R.A.M.*, xix, p. 374] in 100 gals. water. This spray adhered very well to tobacco leaves and was superior to the regular copper oxide-oil in controlling the disease, in causing no plant injury, and in giving better residual protection after spraying was discontinued. Copper oxide-oil was much superior to Bordeaux mixture. Second-best results were obtained with benzyl salicylate ($\frac{1}{4}$ lb. dissolved in 1 gal. cottonseed or soy-bean oil, emulsified and diluted to 100 gals.), but occasionally this spray caused growth retardation in treated plants and did not give quite such a good residual protection. Salicylic acid and zinc salicylate at the rate of $\frac{1}{2}$ lb. dissolved in 1 gal. oil, emulsified and diluted to 100 gals., were found to give effective control, but tended to cause plant injury. Promising results were obtained with butoxyethyl salicylate, dinitrosalicylic acid, and salicyl salicylic acid, all at the rate of $\frac{1}{2}$ lb. in oil. Most of the salicylates do not appear to be critical materials, but difficulties regarding availability and price may be expected.

Magee (C. J.), Morgan (W. L.), & Johnston (A. N.). **Control of spotted wilt of Tomatoes.**—*J. Aust. Inst. agric. Sci.*, viii, 3, pp. 115–117, 1942.

During the past 15 years, spotted wilt has become the most destructive disease of tomatoes in the urban areas of the New South Wales coastal district [*R.A.M.*, xv, p. 538; xxi, pp. 244, 309]. The condition has also caused important losses in inland areas in some seasons. The plants become affected in the seed-bed, after setting out, and in various stages of early and late maturity. Glasshouse crops are not, as a rule, seriously affected.

In a test made at Hawkesbury Agricultural College, Richmond, in an area where incidence had been high the year before, a number of plots of Potentate tomatoes were sprayed with tartar emetic bait to kill the vectors *Thrips tabaci* and *Frankliniella insularis*. Spraying was begun soon after the seedlings appeared above the ground, and was repeated twice every week until planting out. Field applications were made once or twice a week and were repeated after rain. The solution used in the seed beds was 1 oz. tartar emetic, 4 oz. brown sugar, and 4 gals. water, while after planting out the amount of tartar emetic was doubled.

The average infection was 9, 12, and 27 per cent. for the plots treated twice a week, once a week, and not treated, respectively. It is concluded that the method is effective and if tartar emetic could be procured at a reasonable price would doubtless prove commercially profitable. In areas in which the expected incidence amounted to over 20 per cent., spraying once a week would probably be well repaid, while in the seed-bed the treatment would be worth while even with a lower incidence of infection. A suitable strength would, perhaps, be 1 oz. tartar emetic for 4 gals. of water.

Andrus (C. F.), Reynard (G. B.), & Wade (B. L.). **Relative resistance of Tomato varieties, selections, and crosses to defoliation by Alternaria and Stemphylium.**—*Circ. U.S. Dep. Agric.* 652, 23 pp., 4 figs., 2 graphs, 1942.

A tabulated account is given of the preliminary results of a comprehensive breeding programme initiated at the United States Regional Vegetable Breeding Laboratory, Charleston, South Carolina, and aimed at the development of tomatoes resistant to defoliation diseases, commencing with early blight (*Alternaria solani*) and grey leaf spot (*Stemphylium solani*). The technique of artificial infection, involving the preparation of inoculum with a mechanical liquefier, has already been described [*R.A.M.*, xx, p. 546]. Up to the time of writing, some 200 introductions and varieties out of over 1,000 available have been tested under controlled conditions. All proved to be susceptible to *A. solani* when the infection level was kept sufficiently high, and dilution of the inoculum to a reasonable degree resulted in an accession of tolerance among selections of the currant tomato (*Lycopersicum pimpinellifolium*) and *L. peruvianum*, and to a lesser extent in certain commercial varieties of *L. esculentum*, e.g., King George, Danish Extra Early, Devon Surprize, and some sister lines of Pan America. The Targinnie Red variety, reputed to be resistant to defoliation in the field, showed a barely significant degree of tolerance in these trials, apart from a few individual plant selections, but the absence of severe stem infection may be worthy of note.

Outstanding resistance to *S. solani* occurred among selections of *L. pimpinellifolium* especially P(lant) I(ndustry) 79532 and hybrids of this species × *L. esculentum*, many of the former being likewise resistant to *Fusarium* [*bulbigenum* var. *lycopersici*] and some significantly tolerant of early blight. In the hybrid progenies tested, however, no significant correlations could be discerned between resistance to *S. solani* and a similar reaction to *A. solani*.

Although none of the resistant segregates obtained from crosses of *L. pimpinellifolium* × large-fruited *L. esculentum* bore fruits equal to the latter in size, many were intermediate and represented a definite advance towards the commercial type.

Andrus (C. F.), Reynard (G. B.), Jorgensen (H.), & Eades (J.). **Collar rot resistance in Tomatoes.**—*J. agric. Res.*, lxv, 7, pp. 339–346, 2 figs., 1942.

A tabulated survey is given of the collar-rot ratings of a large number of tomato varieties and clonal selections inoculated with aqueous suspensions of macerated *Alternaria solani* cultures by the technique already described [see preceding abstract], which produced 100 per cent. infection on the most susceptible varieties. Among the most resistant were Semperfructifera, P(lant) I(ntroduction) 118787, P.I. 117228, Erste Ernte, King George and a selection from the same variety, P.I. 119105, Targinnie Red Selection, Tomato No. 73, P.I. 127467, Danish Extra Early and a selection, Devon Surprize, Soleil Levant, Ailsa Craig, Cherry, P.I. 120273, *Lycopersicum pimpinellifolium* × Marglobe (F5), Targinnie Red and a selection, Danish Export, P.I. 126913, P.I. 118789, P.I. 138628, Norduke, Riverside, Cereza, P.I. 134208, and Lucullus, all of which were rated at 75 and upwards, implying that the collar lesions were very shallow or showed a definite tendency to heal.

Resistance to collar rot is correlated with a reduced degree of susceptibility to defoliation by the same pathogen. Considerable evidence was forthcoming that many desirable varieties are heterogeneous and segregating for collar rot resistance, so that selection among these might quickly yield desirable resistant strains. It is suggested, for example, that the varieties Norduke, Prairiana, and Riverside might be raised to a highly resistant level by clonal selection and even now these varieties might be substituted for the highly susceptible ones at present preferred. The breeding of resistant varieties by crossing between collar rot-resistant and the most popular but susceptible varieties appears quite practicable.

SARTORY (A.) & MEYER (J.). **Le parasite du Noyer Gnomonia leptostyla (Ces. & De Not.) Klebahn et son cycle évolutif.** [The Walnut parasite *Gnomonia leptostyla* (Ces. & De Not.) Klebahn and its developmental cycle.]—*C. R. Acad. Sci., Paris*, ccxii, 13, pp. 567–569, 1941. [Abs. in *Biol. Abstr.*, xvi, 8, p. 1894, 1942.]

The perithecia of *Gnomonia leptostyla*, the agent of walnut anthracnose [*R.A.M.*, xviii, p. 354], are formed in the cortical parenchyma of *Mercurialis perennis*. The ascospores infected walnut leaves in inoculation experiments, and established the genetic connexion between the imperfect (*Marssonia* [*Marssonina*] *juglandis*) and reproductive stages of the pathogen.

PARKIN (G.). **Fungi associated with typical truewood decays observed in Victorian forest trees.**—*Aust. For.*, vi, 2, pp. 82–86, 1942.

In 1938, a general survey of the decay occurring in mountain ash [*Eucalyptus regnans*] forests in Victoria was made by L. D. Refshauge (*Vict. For.*, ii, 3, 1938). In the following year, the ash belt was largely devastated by fire, and subsequent investigations were carried out mainly in the burnt areas. A tabulated account is given of the fungi responsible for the decay of 11 specimens of *E. regnans*, two each of *E. viminalis* and *Pinus radiata*, and one each of *E. capitellata*, *E. obliqua*, *Nothofagus cunninghamii*, *Acacia dealbata*, *Banksia integrifolia*, *Cassinia aculeata*, and *Olearia argophylla*, from which it appears that different organisms may produce similar effects on various hosts, e.g., a white, spongy rot was found to be due to *Trametes ochroleuca* in *B. integrifolia* and to *Irpex obliqua* in *E. regnans*. Another fungus causing a white, spongy rot of *E. regnans* was a species of *Poria* (? *Polyporus semi-supinus*), with hyaline hyphae and clamp-connexions measuring 1·5 to 4 and 6 μ, respectively, while *P. caesius* was responsible for a white, stringy rot. *Fomes rimosus* caused a yellowish, spongy rot of *E. regnans*, with a brown discoloration of the outer wood, while the same host was infected by a species of *Poria* (V), with light brown, knobby hyphae, 2 to 4 μ in diameter, and clamp-connexions 3 to 4 μ, which induced a brown, spongy rot (small, white pockets only in the comparatively sound parts), by *P.* (?) *medullapanis* (brown, cubical rot), and by *Ganoderma applanatum*. *Polyporus* (?) *semisupinus*, in addition to the above-mentioned white, spongy rot on a branch of *E. regnans*, was found to be the agent of a white pocket rot on a fallen log. Spongy rots of *E. viminalis* were caused by *Hexagonia gunnii* and *F. robustus* (the latter white with brown mycelial pockets); *Stereum illudens* imparted to the outer wood of *N. cunninghamii* a striped, powdery aspect; an orange, spongy rot of *A. dealbata* was traced to *T. cinnabarina*, *Polystictus versicolor* was shown to be the agent of a white, spongy decay of the centre of *C. aculeata*, with black zone lines in the outer part; *I. zonatus* produced a soft, white spongy rot of *O. argophylla*. *Poria* sp. III (? *P. macrospora*, with hyphae 1 to 4 μ and clamp-connexions 3 to 4 μ) caused a stringy to spongy, powdery decay of an *E. obliqua* pole; and the decay of a door architrave made from *Pinus radiata* wood was shown to be due to *P. ferruginosa*.

WEDDELL (D. J.). **Damage to Catalpa due to recreational use.**—*J. For.*, xl, 10, p. 807, 1 fig., 1942.

The large cankers on the trunks, 4 to 5 ft. above the ground, of *Catalpa bignonioides* trees in a 23-year-old plantation in an arboretum at the University of Georgia were found to be due to *Hypoxylon rubiginosum*, following injuries inflicted by fishermen in the course of collecting the larvae of *Ceratomia catalpae* for bait.

GROSJEAN (J.). **Het parasitaire Karakter van eenige Polyporaceeën.** [The parasitic character of certain Polyporaceae.]—Thesis, Univ. Amsterdam, 96 pp., 1942. [Abs. in *Z. PflKrankh.*, lii, 9–10, p. 464, 1942.]

Field and laboratory experiments on living trees and cut branches, respectively, indicated that certain Polyporaceae, commonly inhabiting old tree trunks, act as

true parasites, though their progress is very slow and infection occurs only when the oldest annual rings are inoculated, depending for its success, moreover, on the nature of the substratum, wood being superior to bread in the laboratory tests. An isolate of *Fomes igniarius* from *Amelanchier vulgaris* gave positive results on oak (*Quercus pendunculata*), poplar (*Populus alba*), and alder (*Alnus incana*), one from birch (*Betula verrucosa*) on alder (*A. glutinosa*); a strain of *F. laricis* attacked Douglas fir (*Pseudotsuga douglasii* [*P. taxifolia*]), and an isolate of *F. pomaceus* was pathogenic to bird cherry (*Prunus avium*).

STARR (G. H.). **The control of chlorosis in Cottonwood trees and other plants.**—*Bull. Wyo. agric. Exp. Sta.*, 252, 16 pp., 5 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 5, p. 692, 1942.]

Cottonwood [*Populus* (?) *deltoides*] and other trees in the Laramie district and elsewhere in Wyoming are stated to sustain severe damage from a form of chlorosis associated with iron deficiency and curable by the direct application of ferric salts, preferably by the injection of ferric phosphate into holes in the tree. Of 113 trees treated by this method in 1938, only 27 were found to require a further application at the end of the 1941 season. Other ferric salts, especially ferric citrate, were also used for the same purpose with satisfactory results. Injections of ferrous salts were ineffectual, but a solution of ferrous sulphate (copperas) in spray form corrected the chlorotic condition of herbaceous plants, shrubs, and small trees.

BANERJEE (S.) & GHOSH (T.). **Preliminary report on the occurrence of higher fungi on Bamboos in and about Calcutta.**—*Sci. & Cult.*, viii, 4, p. 194, 1942.

Of the 31 higher fungi collected on bamboo (one of the most valuable forest products of India) in and around Calcutta during the last 15 years, seven occurred on the living plant, viz., *Polyporus durus*, *P. friabilis*, *Ganoderma lucidum*, *Amauroderma rugosum*, *Trametes persoonii*, *Merulius similis* (apparently restricted to this one host), and *Stereum percome*. The dead wood used for fencing harboured, besides the above-named and other species, *Schizophyllum commune*, *Irpex flavus*, *Guepinia spathularia*, and *Daedalea flavida* (hexagonal form).

MCINTYRE (H. L.). **White Pine blister rust control policies in New York State.**—*J. For.*, xl, 10, pp. 782–785, 1942.

Following a survey of the measures adopted in New York State for the control of white pine blister rust [*Cronartium ribicola*: *R.A.M.*, xi, p. 486] since its discovery on cultivated black currant leaves in 1906, the writer refers to the studies recently conducted by W. H. Snell on the importance of red and white currants in connexion with the eradication programme [ibid., xxi, p. 533]. In view of the data so far collected, the destruction of these bushes on a 900-ft. zone round white pine has been discontinued, the maximum radius now covered being about 300 ft. In young plantings or natural stands (12 to 20 years old) growing adjacent to woodlands or swamps, on 128 of which, comprising 170,860 trees, the incidence of infection averaged 10 per cent. in 1938–9, a 50-ft. instead of 900-ft. protective zone is now deemed to be sufficient on the strength of evidence accumulated by E. W. Littlefield (Department of Conservation).

Blister rust control in Washington State.—*J. For.*, xl, 10, pp. 806–807, 1942.

Since 1935, Work Projects Administration employees have been engaged in white pine blister rust [*Cronartium ribicola*] control in the Clearwater, St. Joe, Cœur d'Alene, Kanisku, and Mt. Spokane forests, Washington, the number of men available for this purpose reaching a maximum of 5,700 in 1936 and falling to 300 in 1941. During the period covered by the operations, 110,500,000 trees have been eradicated over 600,000 acres, but the large acreage remaining to be cleared (800,000 acres) has necessitated the expansion of the campaign under a new project calling for the joint support of

the W.P.A. and the United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, the former body to provide funds totalling $23,053 and the latter a contribution of $6,981.

JOY (E. L.). **Recent developments in White-Pine blister rust control in the Northwest.**—*Northw. Sci., Wash.*, xvi, 3, pp. 55–58, 1942.

This is a review of the organization and application of the white pine blister rust [*Cronartium ribicola*] control programme in the Pacific Northwest [see preceding abstract], which falls into three periods, viz., (1) 1923 to 1932, occupied by the development of working methods, (2) 1933 to 1936, marked by outstanding progress, and (3) 1937 to 1941, identified with the difficult problem of holding gains previously made with a greatly reduced supply of labour. During the first of the three periods, initial operations were conducted on 215,169 acres (8 per cent. of the total 2,670,000 acres under white pine) and re-working on 6,570 acres, representing only a fraction of 1 per cent., the corresponding acreages covered from 1933 to 1936 (under the Federal emergency unemployment relief scheme) being 1,405,867 acres (52 per cent.) and 70,426 acres (5 per cent.), respectively, and from 1937 to 1941, 252,100 and 323,100 acres, respectively. Important developments in the three principal methods of *Ribes* eradication, namely, hand-grubbing, chemical treatment, and clearance with bulldozers [*R.A.M.*, xviii, p. 359] are described and their present status discussed.

RODGER (G. J.). **South Australia. Woods and Forests Department. Annual Report for the year ended 30th June, 1941.**—12 pp., 1942.

In the section of the report dealing with forest protection (pp. 5–6), a dying of *Pinus radiata* tops at Mount Crawford, which is under investigation by the Waite Research Institute, Adelaide, is stated to be tentatively attributed to a local soil-drought condition, the same factor being held responsible for a widespread yellowing, browning, and ultimate death of the seedlings. A fungus resembling *Diplodia pinea* caused losses among *P. pinaster* seedlings at Mount Gambier, while *Jacaranda* plants at Belair were attacked by *Botrytis cinerea.*

LUDBROOK (W. V.). **The effect of various concentrations of boron on the growth of Pine seedlings in water culture.**—*J. Aust. Inst. agric. Sci.*, viii, 3, pp. 112–114, 1942.

The growth rate of *Pinus radiata* seedlings in water culture [*R.A.M.*, xx, p. 40] increased with increase in the boron concentration of the nutrient solution up to 0·05 p.p.m. of added boron. Conspicuous boron deficiency symptoms appeared in seedlings grown in a nutrient solution containing 0·005 p.p.m. of added boron, and very slight symptoms in one containing 0·01 p.p.m. They were not observed when seedlings were grown in solutions containing 0·05 or more p.p.m. Boron toxicity symptoms developed in older seedlings grown in solutions containing 10 or more p.p.m. of added boron, but not in those containing 5 p.p.m. or less. 'Fused' needles occurred sporadically in boron-deficient cultures, but it was not possible to produce them at will by withholding boron, and it became evident that the field symptoms of needle fusion are not due to boron deficiency.

EKSTRAND (H.). **Förgiftning av växter genom ett fluorhaltigt träimpregneringsmedel.** [Toxicity to plants of a fluorine-containing wood preservative.]—*Medd. Växtskyddsanst., Stockh.*, 36, 32 pp., 6 figs., 1941. [German summary.]

In a nursery-garden near Stockholm severe injury was observed in 1936–7 on lily of the valley and *Begonia* in a greenhouse caused by the fumes of fluralsil [*R.A.M.*, xxi, p. 277], a zinc- and fluorine-containing disinfectant used on the woodwork. The toxic action was found to arise in part through the direct absorption of the preservative by the roots of the plants and partly from the effects of the gaseous

fluorine compounds (silicofluoride or hydrofluosilicic acid) produced by the dissolution by fluralsil of the acids in the wood. Heavy damage was experimentally induced by the fluorine gases [cf. ibid., xxi, p. 151], not only on the above-mentioned plants, but also on *Asparagus sprengeri*, *Cyclamen*, and *Solanum capsicastrum*, *Hydrangea* and tomato being less susceptible. It is evident from these investigations that fluralsil or other fluorine-containing antiseptics are unsuitable for use in greenhouses and on benches.

TRESCHOW (C.). **Zur Kultur von Trametes auf sterilisiertem Waldhumus.** [On the culture of *Trametes* on sterilized forest soil.]—*Zbl. Bakt.*, Abt. 2, civ, 8–10, pp. 186–188, 1941.

In experiments at the Royal Veterinary and Agricultural College, Copenhagen, *Trametes radiciperda* (*Fomes annosus*) failed to grow on acid (P_H 4·2) forest humus from a 70-year-old spruce stand in the natural state, but developed satisfactorily on the same medium subjected to pasteurization or sterilization. No growth was made on autoclaved soil inoculated with *Trichoderma* sp., but the introduction of *Bacillus subtilis* or *Actinomyces* sp. into the substratum did not impede the vigorous development of *F. annosus*. Presumably the inability of the latter to grow on the natural humus is a result of its weakness as a competitor with other fungi.

BARGHOORN (E. S.). **The occurrence and significance of marine cellulose-destroying fungi.**—*Science*, N.S., xcvi, 2494, pp. 358–359, 1942.

This is a preliminary note (a detailed account is being prepared for publication in collaboration with Dr. D. H. Linder) on a number of fungi (Pyrenomycetes and Fungi imperfecti), isolated by the author from wood blocks submerged for six to ten months in the sea or from decaying piling in various Massachusetts harbours. These cellulose-destroying aquatic fungi, which are stated to be of considerable economic importance in the destruction of cordage and wood exposed to marine conditions, were found to be of very common occurrence along the North Atlantic Coast with the present known range from Newfoundland to New York Harbour.

SCHULZE (B.) & THEDEN (GERDA). **Das Eindringen aufgestrichener Holzschutzmittel in Kiefernsplintholz.** [The penetration of wood-preservative coats into Pine sapwood.]—*Holz Roh-u.-Werkstoff*, v, 7, pp. 239–247, 12 figs., 1 diag., 1 graph, 1942.

At the National Material Testing Station, Dahlem, Berlin, the writers carried out a series of experiments to determine the principles underlying the penetration of oily and watery preservatives into pine sapwood and their practical application in the protective treatment of wood.

The medullary rays were found to act as channels for the passage of both types of liquid from the surface to the interior, the intercellular spaces of the parenchyma providing ingress to the deeper xylem layers and the longitudinal fibres being reached by way of the pits. The narrow lumina of the summer wood absorb most of the preservative substance, the wider spaces of the spring wood being usually, though not invariably, empty. At this stage the movement of the oily liquids is brought to a standstill, whereas those of a watery consistency may, in the presence of sufficient moisture, saturate the cell walls and diffuse further along them; if the wood is dry, on the other hand, it withdraws water from the solution and thus arrests its further progress.

Measurements of the penetration depth of oily and watery protective coatings into pine sapwood of varying moisture contents yielded the following results. As long as the moisture content does not exceed the fibre saturation point, it does not affect the depth of penetration of carbolineum, but once this mark is over-stepped and the lumina are full of water, the inward movement of oleaginous protectives is partially or wholly

impeded. The depth of penetration is proportional to the quantity of oil used, amounting to approximately 3, 4·5, 6, and 8 mm. for 0·625, 1·25, 1·875, and 2·5 gm., respectively, regardless of whether the treatment is carried out at one time or six-hour or three-day intervals. In the case of watery solutions, the depth of penetration increases *pari passu* with rising humidity. Very dry (including air-dry) wood is more deeply penetrated by dilute than by concentrated solutions, whereas the latter percolate more freely through damp wood. As with oil coatings, the depth of penetration of salts is proportional to the quantity applied, but an interruption of the treatment leads to quite different results from those observed with the oleaginous preservatives. Once the first coat of a salt preparation is dry, a subsequent application does not extend the depth of penetration but merely induces an accumulation of the disinfectant in the zone involved.

NIETHAMMER (ANNELIESE). **Wachstumsmöglichkeiten mikroskopischer Pilze auf Sulfitzellulose and Holzschliff sowie Sulfitablauge.** [The growth potentialities of microscopic fungi on sulphite cellulose and mechanical wood pulp, as well as on sulphite spent lye.]—*Holz Roh-u.-Werkstoff*, v, 8, pp. 269–273, 4 figs., 1942.

A comprehensive account is given of the writer's studies at the German Technical College, Prague, Czechoslovakia, on the growth of moulds on sulphite cellulose, mechanical wood pulp, and sulphite spent lye. The moulds were isolated in pure culture on the synthetic medium of Stapp and Bortels [*R.A.M.*, xxi, p. 514] from three sources, viz., (a) seeds and fruits, (b) soil samples, and (c) sulphite cellulose and pulp.

The organisms developing on sulphite cellulose and/or wood pulp fall into four groups, viz., (1) characterized by profuse superficial growth without perceptible penetration into the fibres, e.g., *Mucor silvaticus*, *Thielavia* [*Thielaviopsis*] *basicola*, *Penicillium glaber*, *P. notatum*, *P. expansum*, *P. luteum*, *P. purpurogenum*, and *Stysanus stemonites* from pulp and cellulose; (2) species making little superficial growth but adhering firmly to the substratum, which is clearly permeated though not visibly disorganized, e.g., *Trichoderma koningi* (widespread on all the materials examined), *Fusarium* spp., and *Cladosporium herbarum*; (3) species making copious aerial growth besides infiltrating into the substratum without, however, causing perceptible softening, i.e., *Aspergillus niger* and *A. glaucus*, both of rare occurrence in the material under observation, being isolated once from pulp and developing only at 30° to 32° C.; (4) species of slow but vigorous growth, at first primarily aerial but later invading and definitely softening the substratum, e.g., *Dematium* [*Pullularia*] *pullulans*, which gradually converts portions of both cellulose and pulp strips into a black, soft, slimy mass; *Synsporium biguttatum*, isolated from cellulose and rapidly transforming the strips into a soft mass; and *D.* (*Endomycopsis*) *albicans*, from the same sample of cellulose as the foregoing.

Mixed cultures of various species of moulds generally caused more extensive deterioration of cellulose and pulp than one alone, particularly fruitful in this respect being the co-operation between *Penicillium luteum* and *T. koningi* or *Pullularia pullulans*, *T. koningi* and a species of *Fusarium*, and *F. orthoceras* and *P. pullulans*.

In contrast to the luxuriant growth made by the moulds on cellulose and pulp, development on the spent lyes of sulphite cellulose, diluted with two-thirds of tap water, was poor, a noteworthy feature being the accumulation of oil and fat indicative of degeneration.

HASKELL (R. J.) & DOOLITTLE (S. P.). **Vegetable seed treatments.**—*Fmrs' Bull. U.S. Dep. Agric.* 1862, 17 pp., 4 figs., 1942.

This is a revision of the bulletin of the same number published in 1940 [*R.A.M.*, xxi, p. 112], embodying the results of the most recent researches on the application

of vegetable seed, root, and tuber treatments for the control of fungal and bacterial diseases.

CALDWELL (J.) & PRENTICE (I. W.). **A mosaic disease of Broccoli.**—*Ann. appl. Biol.*, xxix, iv, pp. 366–373, 1 pl., 1942.

A mosaic disease of broccoli, believed to be identical with the cauliflower mosaic described by Tompkins from California [*R.A.M.*, xvii, p. 6], is reported from Devon and Cornwall, where it has been observed every year since 1936. The disease is stated to be widespread and in some seasons very serious, affecting as many as 75 per cent. of the plants in a field or even rendering a whole crop unmarketable. The symptoms, which vary with environment and probably the variety of broccoli, consist in vein-clearing followed by veinbanding and necrotic spotting. Occasionally the leaves appear more or less uniformly mottled. Masking of symptoms is common, and is favoured by warm weather. The disease was readily transmitted to healthy plants by juice inoculation (using carborundum powder) and by the vector *Brevicoryne brassicae*, which is also mainly responsible for the spread of the disease under natural conditions. All of the 20 commercial varieties of broccoli and seven of cauliflower tested were found to be highly susceptible to the virus. The host range of the virus includes Brussels sprouts, cabbage, colewort (*Brassica oleracea* var. *capitata*), kale, savoys, sprouting broccoli, kohlrabi, rape, swede turnip, radish, and charlock. In experiments with the vector, apterous insects became infected after 40 minutes' feeding on a diseased plant, such infective aphids transmitting the virus in a feeding period of 20 minutes. Negative results were obtained in small-scale trials with alate insects. The virus is inactivated by heating for 10 minutes at 80° C. but not at 75°, by storing at 22° for eight days but not for seven, and by dilution to 1: 3,000 but not by one to 1: 2,000. The infection of seedlings in the spring might arise either from the broccoli crop of the previous year or from some intermediate host, such as swede, or from hedgerow weeds.

CALDWELL (J.) & PRENTICE (I. W.). **The spread and effect of Broccoli mosaic in the field.**—*Ann. appl. Biol.*, xxix, iv, pp. 374–379, 1 pl., 1 diag., 1942.

Field observations on the spread of broccoli mosaic [see preceding abstract] carried out from 1938 to 1941 on two Devonshire farms showed that infection spreads rapidly from primarily infected plants, e.g., those probably already infected in the seed-bed before transplanting, to healthy ones. Examination of seed-beds, which are usually placed alongside a hedge, suggested that the seedlings contract infection from diseased hedgerow weeds. When the seed-bed was placed as far as possible from the hedge, primary infections were reduced from about 30 to under 1 per cent. Spraying of seedlings with nicotine soap solution had little effect in checking severe infestation of aphids, as it merely cleared the way for more insects from neighbouring hedgerows. The disease appeared to weaken the ability of the plant to resist frost, probably because the diseased plants usually shed their leaves after frosting, leaving the curds unprotected. Early roguing is recommended for the control of early infections, which are particularly dangerous because they serve as foci of infection.

MOURASHKINSKY (K. E.). Борьба с болезнями Сахарной Свеклы в восточных районах. [Control of diseases of Sugar Beet in the eastern districts.]—*Ex* К весеннему севу **1942** года. Сборник статей. [On the occasion of spring sowing in 1942. Collection of papers.], pp. 64–65, Издат. Наркомзема СССР [Publ. Off. People's Comm. Agric. U.S.S.R.], Omsk, 1942.

Diseases of sugar beet are stated to have been studied very little hitherto in Siberia [where large-scale cultivation of the crop dates from 1932 in the Altaian and only from 1942 in the Omsk and other districts of western Siberia]. The only disease records available are occasional notes made by workers of the Byisk [Altaian district] and of

the Phytopathological Laboratory of the Omsk Agricultural Institute. On the basis of these notes, the author considers that blackleg [*Phoma betae* and other fungi: cf. seedling root rot in western Siberia—*R.A.M.*, xvii, p. 368], *Cercospora beticola* [ibid., xx, p. 332], and mosaic [ibid., xvii, p. 440] may be expected to occur throughout western Siberia. It is believed that *C. beticola* may prove even more destructive than in European Russia; so may *Rhizoctonia* [ibid., xix, p. 322] disease which is very prevalent on the old-established crops such as carrots. Of the two rare but destructive diseases: downy mildew [*Peronospora schachtii*: ibid., xx, p. 333] and rust [*Uromyces betae*: loc. cit.], the former alone is expected to acquire significance and that only on the northern boundary of the beet-cultivation area, while powdery mildew [*Erysiphe polygoni*: ibid., viii, p. 6] is likely to be more dangerous on its southern boundary. The differences in the climatic conditions between the European and the Siberian beet-cultivation areas of the Soviet Union do not suggest the possibility of new diseases developing in Siberia, but it is believed that disease development in general will prove to be more destructive under Siberian conditions.

ESMARCH (F.). **Der Wurzelbrand der Rüben.** [Root rot of Beets].—*Kranke Pflanze*, xix, 3–4, pp. 19–23, 1 fig., 1942.

A semi-popular account is given of beet damping-off caused by *Phoma betae*, *Pythium de Baryanum*, *Aphanomyces levis*, *Alternaria tenuis* [*R.A.M.*, xx, p. 440], and *Macrosporium cladosporioides* [ibid., xix, p. 319], the two last-named having only recently been recognized to play a part in the etiology of the disease in Germany, where they appear to be so far restricted to sugar beets. *Phoma betae* is the predominant species among the three first-named pathogens, *Pythium de Baryanum* ranking second in order of frequency and *Aphanomyces levis* third, the ratio being roughly 7 : 4 : 2. The agents of damping-off thrive on heavy, waterlogged, and acid soils, and are further favoured by cold, damp weather at sowing time and during emergence, as well as by insufficient manuring and general neglect of the stands. In addition to cultural measures directed towards the provision of ventilation, dryness, and light, seed treatment with an officially approved fungicide would appear from recent experiments to be of definite, if limited, value [loc. cit.]. According to Pichler (*Nachr-Bl. dtsch PflSchDienst*, xxi, p. 50, 1941), the cost of disinfection is offset by an increase in yield of only 25 kg. per ha.

WATSON (M[ARION] A.). **Sugar-Beet yellows virus. A preliminary account of experiments and observations on its effect in the field.**—*Ann. appl. Biol.*, xxix, 4, pp. 358–365, 2 pl., 1942.

The yellows disease of sugar beet [*R.A.M.*, xix, p. 637] is believed to be underestimated as a potential danger to sugar production in Britain. In a study of the disease carried out during 1940 and 1941 at Rothamsted, experimental beets infected early in the year (June and July) showed severe stunting and necrosis, those infected in August only slight stunting and less necrosis, and those infected in and after September no stunting or necrosis and only localized symptoms. In the field, the typical yellows symptoms probably result from August or early September infections, later ones, though common, having apparently little effect upon the growth of the plants. Diagnosis of yellows is stated to be difficult owing to the variability of symptoms. Thus, the chlorotic areas on leaves vary from pale, water- or greenish-yellow to rich orange or even red; the chlorotic pattern may start anywhere on the leaf, remaining interveinal in some cases and spreading over the veins in others. The chlorotic areas are either waxy or dry and brittle. Necrosis, apical or marginal, follows the chlorosis down the leaf, sometimes overtaking the chlorotic symptoms before they have time to develop. If this happens when the virus has attacked only the tips and margins of the leaves, the symptoms might be mistaken for potash deficiency. Atypical

symptoms, such as green but stunted and leathery, or even brittle leaves, develop not uncommonly under abnormal weather conditions.

The infected plants in the field occur either in patches of varying size or are distributed all over the field singly or in groups of two or three. The patchy type of distribution is believed to be due to infestation by winged aphids (*Aphis fabae* and *Myzus persicae* were used as experimental vectors) early in the season, when few viruliferous individuals are present causing few small foci of infection round which several more plants become infected later following aphis multiplication; whereas the second, scattered, type is probably due to infestation later in the season when there is a higher proportion of viruliferous insects.

The yields of roots and sugar were found to be considerably reduced by virus infection. Thus, early infection of late-sown beet caused a loss of 67 per cent. of the root, and 71 per cent. of the sugar yield, the loss decreasing with later infection and earlier sowing. The main source of infection is stated to be the seed crop, which often contains a high percentage of virus-infected plants from which the aphids carry the virus to the root crop. The infestation by *A. fabae* occurs comparatively late in the season and is chiefly performed by walking aphids, although the winged aphids produced late in the year probably infect the 'steckling' beds and thus carry over the infection to the next year. The intensity of virus infection depends not so much on the number of insects invading a field, but on the proportion of viruliferous individuals among them and on the proximity of the field to the source of infection, as the vectors lose their infectivity through prolonged fasting. Moreover it depends on subsequent aphid multiplication which is favoured by adverse growing conditions. The factors encouraging early and rapid spread of yellows comprise late sowing, poor cultural conditions, and proximity of the seed crops to the root crops. It is suggested that the growing of seed in the large root-growing districts should be discontinued and that early and intense aphid infestation should be at once brought under control by spraying or fumigation.

Gram (E.). **Mosaiksyge i Runkelroer, Sukkerroer og andre Beder.** [Mosaic disease of Fodder, Sugar, and other Beets.]—*Tidsskr. Planteavl*, xlvi, pp. 686–703, 6 figs., 1942. [English summary.]

Fodder, sugar, and red beets and spinach in Denmark are subject to a mosaic attributed to *Beta* virus 2 [beet mosaic virus], to which *B. maritima* also reacted positively in aphid transmission experiments. In the seed-producing districts where the disorder is prevalent, up to 100 per cent. infection may occur in some seasons, causing losses of 30 and 50 per cent., respectively, in the fodder beet and seed yields. The extent of the disease depends on the amount of aphid infestation, the incubation period ranging from 8 to 16 days and the symptoms varying greatly. The virus overwinters in beets stored for seed production, and may be acquired by aphids feeding on the sprouted plants in the spring. The mechanical spread of the infective principle in the course of harvesting operations is without practical significance, and transmission through the seed or soil has not been observed. Diseased plants can usually be sorted out in the autumn from the lots intended for seed production, and the loss of seed may be considerably reduced by early planting, liberal manuring, and favourable weather conditions. The timely control of aphids effectively prevents new infection. Fodder beets suffer more severely than the sugar-yielding sorts from the mosaic virus, which is of no importance on garden beets and *B. maritima*. No indication of varietal resistance has been obtained.

Larson (A. O.) & Hallock (H. C.). **Time of planting susceptible Beans in relation to curly top injury in south-central Idaho.**—*J. econ. Ent.*, xxxv, 4, pp. 565–569, 3 figs., 1942.

A tabulated account is given of the writers' experiments from 1936 to 1939,

inclusive, to determine the relation between planting time and curly-top development in susceptible bean [*Phaseolus vulgaris*] varieties in south-central Idaho [*R.A.M.*, xx, p. 555], from which it appears that severe infection seldom occurs in stands sown just before or at the start of the spring migration of the beet leafhopper (*Eutellix tenellus*) in the Twin Falls district and the immediately eastward area (average date over a 13-year period 27th May). The cultivation of garden varieties, susceptible Great Northern, or Pinto beans in the western regions of the area under observation is attended by a very high degree of risk at any planting date, but early sowing offers some prospect of a reduction of curly-top losses.

Braun (A. E.). **Resistance of Watermelon to the wilt disease.**—*Amer. J. Bot.*, xxix, 8, pp. 683-684, 1942.

To ascertain whether differences in susceptibility to *Fusarium oxysporum* f. *niveum* [*F. bulbigenum* var. *niveum*: *R.A.M.*, xxi, p. 362] among watermelon varieties might be due to the relative amount of some chemical compound present, studies were conducted on the very susceptible variety Kleckley Sweet and the less susceptible Citron. Plants were grown in the field, harvested when six weeks old, dried at 60° C. and ground to pulp, stems and roots being kept separate. Aqueous extracts of the dried pulp were added to liquid culture media inoculated with spores of the fungus. After two weeks the medium with the Citron shoot extract contained considerably less growth than the control. No differences from the control were observed in the cultures with the Citron root extract or the Kleckley Sweet shoot or root extracts. Material extracted with ether from dried pulp had no effect on the growth of the fungus. It thus became apparent that the water-soluble extract contained a substance bearing some relation to susceptibility. This substance, present in a higher proportion in the less susceptible Citron than in the more susceptible Kleckley Sweet, was ascertained to be acetic acid, not necessarily present in the free state. The evidence obtained indicated that fungal growth in Citron is retarded by some material from the shoot, which may be acetic acid, and not from the root, the pathogen establishing itself in the roots of both varieties.

One part of acetic acid in 100 parts of nutrient solution completely inhibited the growth of the fungus, while at 1 in 500 it slightly retarded growth.

Wilhelm (A. F.). **Untersuchungen zur Frage der Kupferersparnis bei Reben (-Plasmopara viticola Berl. et De Toni).** [Investigations on the problem of copper economy in Vines (*Plasmopara viticola* Berl. & De Toni).]—*Wein u. Rebe*, xxii, 3, pp. 49–70; 4, pp. 87–96; 5, pp. 111–119, 1940. [Abs. in *Biol. Abstr.*, xvi, 8, pp. 1897–1898, 1942.]

In connexion with the copper economy campaign in Germany, the writer states that aluminium compounds are unsuitable for the replacement of the former element in the treatment of vine downy mildew (*Plasmopara viticola*) [*R.A.M.*, xxi, p. 439], while the value of Martini brown depends on its copper content. One satisfactory method of reducing copper consumption consists in the addition to sulphur-lime sprays, themselves of only limited efficacy, of small quantities of copper, and another effective fungicide is composed of 0·25 per cent. Bordeaux brown plus copper sulphate, magnesium sulphate, and calcium oxide. Bordeaux brown is more resistant to washing off by rain than copper oxychloride, with which the use of an adhesive is indicated.

Sixteenth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1941–42.—33 pp., 1942.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*,

xxi, p. 2]. *Sphaerella linorum*, the agent of 'pasmo' disease of flax, is common throughout the Dominion on the introduced weed *Linum marginale*.

Beta virus 2 [beet mosaic virus] was transmitted from beet [loc. cit.] to all the silver and red beet varieties obtainable in New Zealand, as well as to sugar beet and spinach.

Nearly 90 per cent. of late-spot infections on Sturmer apples were found to be due to *Neofabraea malicorticis* [see below, p. 140]. Weak summer Bordeaux sprays caused injury to this variety in the Hawke's Bay district, where their use should accordingly be discontinued. Colloidal sulphur alone produced fruit of superior quality and did not injure the foliage. At Appleby a reduction in the incidence of Bordeaux injury was effected by increasing the proportion of lime in the mixture.

Bacterium [*Xanthomonas*] *pruni* was isolated from plum trees at Hawke's Bay, and was also found to be responsible for a fairly severe shot hole of peaches in Auckland.

A combination of boron and potash, preferably with an admixture of nitrogen and phosphates, effectively combated foliar chlorosis of vines and internal browning of the grapes in the Braeburn area.

At the Riwaka Tobacco Research Station heavy applications of manure tended to increase the amount of mosaic infection of tobacco plants from seedling beds, while certain fertilizers [unspecified] also induced an extension of the disease in the field. No significant influence on the development of mosaic was exerted by the use of soils of different textures for seed-beds or by the pulling or disking-in of the previous crop prior to planting.

Botany.—*Rep. Ga Exp. Sta., 1941–42*, pp. 68–75, 1942.

This report [cf. *R.A.M.*, xxi, p. 126] contains, *inter alia*, the following items of phytopathological interest. A species of *Guignardia*, suspected to be distinct from the usual agent of grape black rot [*G. bidwellii*: ibid., xxi, p. 318], is responsible for severe damage to certain muscadine [*Vitis rotundifolia*] varieties, e.g., Stuckey and Irene. The leaves and canes are the main objects of attack, but an extension to the fruit pedicels may involve shelling-off of the berries. In contrast to the lengthy period of ascospore discharge (20 weeks) by *G. bidwellii* on bunch grapes, the corresponding duration in the muscadine species is only about two months. Of the three species of *Phoma* isolated from rotted muscadine berries, only one has so far been found capable of attacking uninjured fruits. *Melanconium fuligineum* [loc. cit.] is the most common occupant of decaying muscadine berries, besides being prevalent on bunch grapes. The fungus readily invades wounded berries, but all attempts to infect uninjured fruits with it have been unsuccessful.

During 1941, black root [ibid., xx, p. 620] was responsible for 40 per cent. of the recorded mortality among beans [*Phaseolus vulgaris*] at Experiment, the corresponding figures for root rots (*Fusarium* and *Rhizoctonia* spp.) and for ashy stem blight (*Macrophomina phaseoli*) and southern blight (*Sclerotium rolfsii*) together being 36 and under 5 per cent., respectively. At Tifton *M. phaseoli* caused 60 and *F.* and *R.* spp. together 25 per cent. of the bean deaths. Ashy stem blight was found to represent the more advanced phase of the disease caused by *M. phaseoli*, which is associated with the production of pycnidia by the fungus, the infection of seedlings and young succulent stems by the hyphae and black sclerotia (*S. bataticola*) being known as charcoal rot. Seeds from pods bearing the pycnidia of *M. phaseoli*, if they germinate at all, almost invariably give rise to diseased (charcoal-rotted) seedlings. The decayed areas resulting from seed-borne inoculum extend from the cotyledons downwards, whereas those arising from infection through the soil may originate either at the cotyledons or soil-level. Seed-borne transmission of *M. phaseoli* is expected to be an important factor in the Coastal Plain where local seed is used. Cross-inoculation experiments with cultures of *M. phaseoli* on sterilized oats kernels from beans, cowpeas, lupins, partridge peas [? *Cassia* spp.], *Lespedeza*, and clover, which were macroscopically and microscopically

identical and produced no pycnidia, gave uniformly positive results, whereas an externally similar isolate from cotton was non-pathogenic to beans and the other plants and vice versa.

Among the strains of watermelons developed in a breeding programme S 87, a superior Stone Mountain type, has proved outstanding in respect of resistance to wilt [*F. bulbigenum* var. *tracheiphilum*] in three years' trials on heavily infested soil. Of the foreign strains tested for resistance to the same pathogen, *Citrullus calocynthis* was better able to withstand infection than any of the indigenous varieties, but the elimination of its bitter flavour and poor quality by back-crossing to watermelon is likely to be difficult.

Two out of ten selections from the hybrid of a commercial tomato and *L[ycopersicum] pimpinellifolium* tested for resistance to wilt (*F.*[*b.* var. *lycopersici*]) in comparison with 23 local lines gave highly satisfactory results, one being also free from nematodes, which caused severe damage to the other, as well as to the home-bred strains; 95 per cent. of the latter were dead when the final counts were made on 4th November. Further selections from the hybrids, combining immunity from wilt and nematodes with resistance to *Septoria* [*lycopersici*], are being crossed with some of the best large-fruited local strains.

The two chief vetch diseases are root rot, caused by several fungi, and false anthracnose (*Protocoronospora nigricans*), which is responsible for extensive defoliation in wet seasons, the common (smooth) and hairy (*Vicia villosa*) varieties mostly grown commercially being fairly resistant to the former but susceptible to the latter disorder.

Two widespread leaf spots are very destructive to cowpeas, namely, *Cercospora cruenta* and *Amerosporium oeconomicum*, the New Era variety being particularly susceptible to the former.

Elrod (R. P.). **The Erwinia-coliform relationship.**—*J. Bact.*, xliv, 4, pp. 433–440, 1942.

A tabulated account is given of the writer's comparative studies at the Rockefeller Institute for Medical Research, Princeton, New Jersey, on 19 strains of *Erwinia*, including *E. solanisapra*, *E. carotovora*, *E. aroideae*, and *E. carotovora*, and 50 representative forms of *Escherichia coli* [cf. *R.A.M.*, xxi, p. 325].

The manner in which the *Erwinia* isolates fermented lactose suggested their classification as aberrant coliforms, the majority approximating, on the basis of their IMViC (indole-methyl red, Voges-Proskauer, citrate) patterns, to *Escherichia freundii*. On the other hand, their gelatine-liquefying capacity, motility, and production of acid in glycerol, denotes a closer relationship with *Aerobacter cloacae*. Sixteen of the *Erwinia* cultures on nutrient broth were pathogenic to carrot or turnip, or both, five being unable to attack the former host, while three were innocuous to the latter. None of the coliform organisms produced any degree of maceration in the vegetable tissues. All but two of the *Erwinia* strains, and 22 out of 50 of the coliform group fermented pectin in a synthetic medium. No correlation was apparent between the ability to disorganize plant tissues and pectin fermentation. The possession of the former character would appear to confirm the validity of a separation between *Erwinia* and the coliforms, though the close relationship between the two groups must be recognized.

Breed (R. S.) & Conn (H. J.). **Bacterial generic names as common nouns.**—*Science*, N.S., xcvi, 2500, pp. 493–494, 1942.

The authors take exception to the usage by bacteriologists of generic names in the plural as common nouns when, as for instance, in the sentence 'none of the rhizobia are able to grow in this medium except *Rhizobium meliloti*', the mistake is made of using 'rhizobia' for 'species' of the genus *Rhizobium* instead of 'individuals' or 'specimens' of this genus. The authors do not oppose the use of such words as 'bacteria', 'bacilli', 'micrococci', or 'streptococci' as long as they stand for individuals and not species.

ISRAILSKI (V. P.) & STRUMINSKAYA (MME E. V.). **Serological examination of plants affected with bacteriosis. III. Examination of legumes for B. medicaginis v. phaseolicola, B. flaccumfaciens, B. phaseoli v. fuscans and others.** Микробиол.]—[*Microbiol.*, x, 4, pp. 480–487, 1941. [English summary. Abs. in *Biol. Abstr.*, xvi, 10, pp. 2339–2340, 1942.]

Extracts of bean [*Phaseolus vulgaris*] plants infected by *B*[*acterium*: *Xanthomonas*] *medicaginis* var. *phaseolicola*, *Bact.* [*Corynebacterium*] *flaccumfaciens*, or *Bact.* [*X.*] *phaseoli* var. *fuscans* gave specific precipitin reactions with sera prepared against the corresponding organism. The best extracts were obtained from finely cut portions of plants kept in water heated to 60° C., clarification being effected by one filtration (preferably not more) through talc. Extracts prepared from healthy seeds yielded non-specific precipitates, which could be eliminated by first treating the extracts with normal serum for two hours at 37° to 40°, followed by a day in the refrigerator, the resultant precipitate being centrifuged off and the clear liquid used for testing. Extracts of infected seeds thus treated gave specific precipitin reactions with the antisera to the species of bacteria causing infection. Dialysis of the seed extracts for 24 hours in a collodion bag against running water also removed the non-specific precipitates. The residue of sediment left in the bag was clarified by centrifugation, after which only the appropriate specific reactions were obtained.

DUBOS (R. J.). **Microbiology.**—*Ann. Rev. Biochem.*, xi, pp. 659–678, 1942.

Included in this review and discussion of some outstanding recent contributions (listed in a bibliography of 162 titles) to the knowledge of bacteriostatic and bactericidal substances are a number relating to the inhibition of bacterial growth by Actinomycetes and moulds, notably species of *Trichoderma*, *Gliocladium*, and *Penicillium*, reference to which has been made from time to time in this *Review*.

BAKER (R. E. D.) & CROWDY (S. H.). **Witches' broom disease investigations. II. Notes on the susceptibility of I. C. S. selections at River Estate to witches' broom disease of Cacao.**—*Trop. Agriculture, Trin.*, xix, 11, pp. 207–209, 1942.

In further investigations into the witches' broom disease of cacao in Trinidad [*Marasmius perniciosus*: *R.A.M.*, xx, p. 453], two-, three-, and four-year-old I. C. S. clones were under observation for susceptibility from 1940 to 1942 at River Estate, where the disease has been severe in recent years. The susceptibility was assessed either by removing and counting all brooms at the end of each month or by removing all brooms in December, and making a single count during March. This second method, based on the observation that 80 per cent. of the annual total of brooms was produced in the three months from January to March, gave as good results as the method of monthly countings. None of the clones was found to be immune or even highly resistant, but data obtained indicate that clones 1, 6, 8, 9, 22, and 98 are worth further trials. It is pointed out, however, that only young trees were tested, no account being taken of mature tree or of pod resistance.

DILLON WESTON (W. A. R.). **Seed disinfection of Barley and Oats.**—*J. Minist. Agric., Lond.*, xlix, 3, pp. 157–160, 2 figs., 1942.

The author describes in semi-popular terms the symptoms of oats and barley stripe (*Helminthosporium avenae* and *H. gramineum*, respectively), and gives recommendations for their control by dusting the seed-grain with one of the approved organic mercurial dressings now on the market [*R.A.M.*, xv, p. 667]. In recent experiments (with R. E. Taylor) at the Cambridge University Farm, six proprietary preparations of this type were tested for the control of *H. gramineum* in a sample of barley seed-grain harbouring 98 per cent. natural infection. The incidence of stripe in the plots treated with the mercurial dressings amounted to only 0·4 per cent. of diseased seedlings, as

against 34 and 29 per cent. in those left untreated or given a formalin sprinkle, respectively.

STRAIB (W.). **Über die Interferenzwirkung von Luftfeuchtigkeit und Temperatur auf das Zustandekommen der Infektion mit Uredosporen verschiedener Getreiderostarten.** [On the interferential effect of atmospheric humidity and temperature on the occurrence of infection by the uredospores of various cereal rust species.]—*Z. PflKrankh.*, l, 11, pp. 529–552, 1940. [Abs. in *Biol. Abstr.*, xvi, 10, pp. 2344–2345, 1942.]

Puccinia glumarum, the agent of yellow rust of wheat, was the only cereal rust among those studied at the Brunswick branch of the Biological Institute in which the several physiologic races showed clear-cut differences in their responses to the relative effects of temperature and incubation period in a saturated atmosphere on uredospore germination and on the initiation of infection by these spores [*R.A.M.*, xxi, p. 410]. The optimum temperature for the germination of *P. glumarum* was below 10° C., for *P. graminis* and *P. coronata* above 20°, and for *P. triticina*, *P. dispersa* [*P. secalina*], and *P. simplex* [*P. anomala*] slightly below this point. For most of the races of *P. glumarum* the maximum germination temperature was 25°, though in some cases 28° was reached, the corresponding degree for the other rusts being 31·5° to 32°. The temperature ranges for spore germination in *P. triticina*, *P. coronata*, *P. graminis* and *P. glumarum* were 5° to 25°, 8° to 25°, 8° to 25°, and 9° to 11°, respectively, the minimum for all species being 1° to 2°, except for *P. coronata*, in which it was 3° to 4°. At the optimum temperature the spores of *P. glumarum* require one to two hours longer for germination than those of the other species under observation. The period needed by *P. glumarum* for the production of full infection in a saturated atmosphere was shorter than in any of the other rusts. At 8° to 10°, the initiation of infection by the uredospores of *P. coronata* and *P. graminis* was much delayed although their germination was about as rapid at the lower temperature as at 20°. It is concluded that the temperature and humidity relations determine the sequence of development of the different rusts, which in Germany opens with *P. glumarum* and closes with *P. coronata* and *P. graminis*, outbreaks of *P. anomala*, *P. dispersa*, and *P. triticina* falling in the intervening period. In other countries, where the overwintering factor assumes major importance, the order of occurrence may be different.

CLARK (F. E.). **Experiments toward the control of take-all disease of Wheat and the Phymatotrichum root rot of Cotton.**—*Tech. Bull. U.S. Dep. Agric.* 835, 27 pp., 3 figs., 1 graph, 1942.

Fertility and soil-sanitation contributions of different organic manures to soils infested by wheat take-all (*Ophiobolus graminis*), as revealed by nitrate nitrogen and available phosphorus contents, microbial counts, and incidence of infection on the host, were studied in greenhouse experiments [*R.A.M.*, xxi, p. 445]. Organic materials giving satisfactory control of the disease, e.g., chicken manure and lucerne tops, markedly increased both the nitrate nitrogen and available phosphorus contents of the soil. In a comparative test with partially composted and fresh manures, only the latter proved effective against *O. graminis*, the nitrate nitrogen disappearing from the former about the time of the onset of the disease. When naturally infested soil, in which wheat had been successfully cultivated under an appropriate fertilizing scheme, was re-cropped to the same host under conditions favouring the parasite, the failure of manurial treatment to eliminate the latter became apparent. On the other hand, the fungus was eradicated from naturally infested soil maintained for three months under moisture and temperature conditions promoting microbial activity but totally devoid of susceptible roots.

Uncontaminated, viable sclerotia of *Phymatotrichum omnivorum*, the agent of cotton root rot, survived as well in sterile, organic-amended, as in sterile, untreated

soil, suggesting that the destruction of these organs is effected by the saprophytic microflora [ibid., xxi, p. 137]. Widely differing types of organic material, including (besides those already enumerated [loc. cit.]) starch, cellulose, ground wheat straw, ground lucerne hay, crimson clover and hairy vetch tops, and commercial peptone, were successfully used at rates of 0·5 to 5 per cent. for the extermination of the sclerotia from both Hunt clay and Wilson loam soils given either the high- or low-nitrogen type of amendment: the incidence of elimination from washed sand was slightly poorer. In tests to determine the influence of the incubation temperature and soil moisture on the efficacy of the organic substances against *P. omnivorum*, 12, 30, 72, and 91 per cent., respectively, of the viable sclerotia were destroyed at 2°, 12°, 28°, and 35° C., respectively, and 59·5, 66·2, and 76·7 per cent., respectively, at 35, 58, and 80 per cent. of the moisture-holding capacity of amended Hunt clay, the corresponding percentages for unamended soil being 37, 38, and 33.

Cutting healthy cotton roots below the crown was found to hasten their colonization by saprophytic fungi, no such effect following the infliction of injuries above the crown. From plants parasitized by *P. omnivorum* but not mechanically injured, *Penicillium* and *Trichoderma* spp., Dematiaceae, and sterile mycelia were encountered with greater, and *Aspergillus* spp. and Mucorales with less, relative frequency on root segments incubated in the moist chamber. About two-thirds of all the root segments recovered from healthy, unwounded plants were free from saprophytic fungi, which developed, however, on four-fifths of those clipped below the crown; at the same time, this practice contributed to the rapid disappearance of the root-rot organism from its host.

Fischer (G. J.) & Noll (W.). **Marchitamiento de Avena provocado por Corticium rolfsii.** [Rot of Oats caused by *Corticium rolfsii*.]—*Rev. argent. Agron.*, ix, 3, pp. 244–248, 1942.

Corticium rolfsii (Sacc.) Curzi was isolated in pure culture on malt agar at 20° to 25° C. from plants of *Avena byzantina* at the Phytotechnical Institute, La Estanzuela, Uruguay, which were observed during March, 1942, to be suffering from dry rot, manifested by a dark yellow, soil-coloured tinge and ultimately by the entire disappearance of the upper parts of the plants under the influence of rain. The roots were found to be covered with strands of the whitish mycelium and chestnut-coloured sclerotia of the imperfect stage of the fungus (*Sclerotium rolfsii*), the basidial (perfect) phase having been subsequently identified in cultures by L. Grodsinsky of the Argentine Ministry of Agriculture. In controlled soil (damp sand) inoculation experiments at 28°, 24°, and 12° to 18°, the incidence of infection reached a maximum at the highest temperature, with only two healthy plants out of the 14 germinating, the corresponding figures for the medium and low temperatures being 19 out of 99 and 78 out of 94, respectively. This is believed to be the first record of *C. rolfsii* on *A. byzantina*.

Sherman (G. D.), McHargue (J. S.), & Hodgkiss (W. S.). **The production of a lime-induced manganese deficiency on an eroded Kentucky soil.**—*J. Amer. Soc. Agron.*, xxxiv, 12, pp. 1076–1083, 1 fig., 1942.

Wolverine oats grown in jars containing badly eroded acid subsoil from Adair County, Kentucky, with a very low active manganese content developed typical grey speck symptoms [*R.A.M.*, xxi, p. 522] on the addition of lime (calcium carbonate) at a rate equivalent to 8,000 lb. per acre. Better growth was obtained by the simultaneous application to the soil of lime and either manganese or copper sulphate or both (at 100 and 50 lb. per acre, respectively), the average yields (in gm. per jar) for the controls and the lime, lime plus manganese sulphate, lime plus copper sulphate, and all three compounds being 64·7, 34·4, 101·5, 97·8, and 93·1, respectively. In comparable tests on a high-manganese soil from Larne County, the growth of the plants was

favourably influenced by the lime treatment, the addition to which of the above-mentioned compounds did not significantly affect the field.

LEUKEL (R. W.). **Chloropicrin as a disinfectant for plant beds.**—*Phytopathology*, xxxii, 11, pp. 1034–1036, 1 fig., 1942.

The writer reports excellent control of *Pythium arrhenomanes* on Colby milo sorghum by the application to the soil of outdoor plant beds of chloropicrin at the rate of 3 c.c. per sq. ft., using a special contrivance to introduce the chemical at a depth of 6 in. [*R.A.M.*, xxi, p. 423]. The treatment was made on 12th May, 1941, the soil being covered with a tarpaulin for four days, and the seed sown on the 29th. At midsummer the plants in the treated beds were vigorous and sound, producing luxuriant heads, whereas those in the control plots were stunted and dying, with unfilled heads. *P. arrhenomanes* was isolated from the crowns and roots of the infected plants.

Color handbook of Citrus diseases.—*Calif. Citrogr.*, xxvii, 3, p. 73, 1942.

The 'Color handbook of Citrus diseases' (90 pp., Calif. Univ. Pr., $3.50) by L. J. Klotz and H. S. Fawcett comprises detailed descriptions of 76 maladies of the crop, with special reference to their control and a reduction of orchard, packing-house, and transit disorders. The work is illustrated by 40 plates, containing 108 full-colour photographs and is designed to meet the needs both of commercial industry and scientific research.

FAWCETT (H. S.) & KLOTZ (L. J.). **Septoria spot of Citrus fruits.**—*Calif. Citrogr.*, xxvi, 1, p. 2, 1 fig., 1940.

Spotting of Valencia orange, lemon, and grapefruit, due to *Septoria citri* and *S. limonum*, is stated to be prevalent in the inland citrus-growing regions of California [*R.A.M.*, xxi, p. 73]. The pale tan or buff, sunken spots, with greenish to reddish-brown borders, mostly do not exceed 1 to 2 mm. in diameter or penetrate below the flavedo, but some of the larger, dark brown lesions may attain a diameter of 4 to 6 or even 10 mm. and extend into the albedo. Some of the spots contain the pycnidia of the fungi, usually in association with the causal organism of anthracnose [*Colletotrichum gloeosporioides*]. In laboratory tests spore germination in *S.* spp. was completely inhibited by 41 hours' exposure to zinc-lime whitewash (5–33–100), zinc-copper-lime whitewash (5–2–33–100 or 10–1–5–100) and Bordeaux mixture (3–2$\frac{1}{4}$–100 or 1–$\frac{3}{4}$–100). For orchard practice the writers advocate an autumn application of 1–$\frac{3}{4}$–100 Bordeaux mixture. In localities such as Tulare county, where a whitewash consisting of 25 lb. lime to 100 gals. water is used, 1 to 2 lb. copper sulphate should be added per 100 gals. The addition of zinc, where required against mottle leaf, is likewise helpful in the control of *Septoria* spots at the rate of 5 lb. per 100 gals.

KLOTZ (L. J.). **Brown rot of Citrus fruit. Important factors in its control in orchard and packing house.**—*Calif. Citrogr.*, xxvii, 1, pp. 6, 23, 1 fig., 1941.

The following recommendations are given for the control of citrus brown rot [chiefly *Phytophthora citrophthora* and *P. parasitica*: *R.A.M.*, xx, p. 571] in California, based on the results of experiments to determine the factors involved in the failure of the standard methods of prevention during the excessively rainy season of 1941. In orchards where cyanide fumigation is practised, Bordeaux mixture 1–1–100 should be applied to the lower 4 ft. of foliage and fruit just before or after the first autumn rain. For the simultaneous control of mottle leaf a spray containing 5 lb. zinc sulphate, 1 lb. copper sulphate, and 4 lb. hydrated lime should be applied to the whole tree. Where cyanide fumigation is not carried out, a more concentrated Bordeaux formula (6–6–100) should be employed. All fruit and foliage should be covered where exanthema (copper deficiency) is present or the grove is subject to frequent wind-driven rains. In very wet seasons, an additional treatment may be given at the end of

January or early in February, while a further precautionary measure consists in spraying the tree trunk and ground beneath.

In the packing-house there are several important factors to be considered in connexion with the occasional decrease in efficacy of the hot water, hot soda ash ($1\frac{1}{4}$ per cent.), or hot soda ash-soap ($\frac{1}{2}$ per cent.) immersion treatment. It was shown, for instance, that the protective action of two minutes' immersion in a soda ash-soap solution at 72° F. tends to be lost if infection took place more than $1\frac{1}{2}$ hours prior to the dip, the fruit (Eureka lemons in the silver stage) being kept in the meantime at 73° to promote rapid spore germination. With an increasing lapse of time between infection and immersion the potency of the treatment gradually declines until after three hours the incidence of decay ranged from 80 to 90 per cent. While the cold solution kills all the brown rot spores on the surface of the fruit with which it comes into contact, it is probably quite ineffectual once the germ-tubes have penetrated the rind; at 70° the fungus reached a depth of 0·024 in. in 24 hours. At a temperature of 117° to 120° the above-mentioned solution protected the lemons from brown rot, even when infection occurred 24 hours previously, but a gradual loss of efficacy then followed until after 36 hours 95 per cent. of the fruit became rotten. In another series of experiments, lemons in the dark green stage, inoculated 24, 34, and 48 hours previously, were immersed in water heated to 119° for periods ranging from 12 seconds to four minutes, followed by five seconds' sprinkling with cool hydrant water. The minimum duration of treatment permitted 35 per cent. decay in the fruit inoculated 24 hours earlier, and 70 per cent. in that left for the two longer periods between infection and immersion. Treatments maintained for two minutes and upwards afforded complete protection to the lemons inoculated 34 hours earlier, while 80 per cent. remained sound even after a dip lasting one minute only.

FAWCETT (H. S.) & KLOTZ (L. J.). **Prevention of brown rot. Proper planting will help avoid a large amount of brown rot gummosis.**—*Calif. Citrogr.*, xxvii, 6, p. 56, 1942.

Brown rot gummosis (*Phytophthora parasitica* and *P. citrophthora*) [see preceding abstract] may begin in the nursery, and the tap- and lateral roots of susceptible stocks should be examined before planting, so that any tree showing cankers or dying-back may be discarded. The 'bare-root' planting system is advocated wherever climatic and other conditions are sufficiently favourable, since it permits of a thorough inspection of the state of the rootstock, but success by this method demands great care. Unduly deep planting should be avoided, the trees being placed at a height (allowing for settling) fully equal to, or slightly in excess of, that obtaining in the nursery. The first main lateral roots should not be more than 1 to 2 in. below the surface of the soil at the trunk. When the trees are planted in ridges, from which the earth may subsequently be partially drawn away to leave the first main lateral roots at the trunk near soil-level, the base of the tree should not be left for any length of time in contact with wet soil. An additional precaution consists in dusting the balls just before planting with 5–1–4 zinc-copper-lime or dipping them in 2–2–100 Bordeaux mixture. The former preparation or equal parts of finely ground copper sulphate and hydrated lime should also be applied in the form of a paste or dust just after planting, and prior to subsequent irrigations if necessary, to the base for 6 to 8 in. above soil-level and down to the first main lateral roots, while in locations subject to heavy infection 2–2–100 Bordeaux mixture may be poured in or sprayed at the base of the young tree after pulling back the burlap from the top of the ball, as a further precaution against an attack on the tap-root.

GREIG (A. M. W). **Preventing infection in Citrus fruit.**—*Orchard. N. Z.*, xv, 6, p. 3, 1942.

For the control of citrus brown rot (*Phytophthora citrophthora*) in the Auckland district of New Zealand, the writer recommends the application of an autumn spray

of 3–4–50 Bordeaux mixture, paying special attention to the foliage and stems within 3 to 4 ft. of ground-level and sowing a cover crop under the spread of the branches. Where the latter practice has been omitted and infection has previously assumed an acute form, the trees should be pruned so as to allow a clearance of 3 ft. between the lower branches and the ground, the soil being frequently stirred. Picking-cases, on return from the lemon assembly depots, should be scraped, dipped in 1 in 1,000 shirlan WS, and stacked under cover. The autumn treatment will further assist in the control of verrucosis [*Elsinoe fawcetti*], melanose grey scab [*Diaporthe citri*], wither tip (*Glomerella*) [*cingulata*], and blast [*Pseudomonas syringae*], cultural measures against the last-named of which should also include the provision of adequate shelter and the hardening-off of autumn growth by the omission of nitrogenous manures in a rapidly acting form or excessive quantities.

FRASER (LILIAN). **Phytophthora root rot of Citrus.**—*J. Aust. Inst. agric. Sci.*, viii, 3, pp. 101–105, 3 figs., 1942.

Citrus collar rot (*Phytophthora citrophthora*) is stated to be serious and destructive in the coastal areas of New South Wales. It generally starts above the bud union, the almost universally used rough lemon (*Citrus limonia*) stock being resistant to the fungus. The root rot phase of the disease appears to be more prevalent on sweet orange (*C. sinensis*) stock, which is more susceptible than rough lemon. Most of the soils in the coastal areas are sandy and well drained, and water does not remain near the roots for long periods.

In heavier soil types, such as those found in the Parramatta and 'Hills' districts and parts of the alluvial flats along the Hawkesbury River, tree vigour has declined in recent years. The roots of affected trees show small to medium-sized lesions extending to the surface of the wood, and situated mainly on the lower half of the root. These lesions appear on roots of all sizes, but only in the most advanced cases do they extend to the crown roots. The lesions enlarge rapidly for a time, and may then stop growing, owing to a change in environmental conditions; a marginal callus is then formed, but is often broken when decay sets in again. Small roots may form at the margin of the lesions. The development of fibrous feeding roots by such trees is invariably much smaller than is the case in sandy, well-drained soils, and fibrous roots are often discovered in a decayed state, with no compensating production of new roots.

P. citrophthora was first isolated by the author in New South Wales from root lesions in September, 1941, from an orchard in the Murrumbidgee Irrigation Area. Decay was progressing rapidly in soil rendered continuously damp by spray irrigation, and protected from excessive heat by permanent grass. The roots showed lesions ranging in size from the small type characteristic of coastal orchards to a foot rot almost as severe as that found on sweet orange stocks in Florida. Subsequent surveys showed that the fungus was widespread throughout the Murrumbidgee Area, in the heavy soils of the coast, and in some parts of the Murray River area.

Experiments with different stocks in glasshouses demonstrated that under wet conditions *P. citrophthora* rapidly attacked the fibrous feeding roots of susceptible varieties, though no decay occurred in uninoculated soil. Saturated soil conditions were not necessary for root decay, but the rate of progress of the decay was determined by soil moisture, and was very slow in comparatively dry soils. Only when the soil was waterlogged for lengthy periods did decay extend from the fibrous roots to the main laterals. Decay of the fibrous roots occurred 24 to 48 hours after inoculation.

The presence of *P. citrophthora* was demonstrated in a few cases showing initial decay of the fibrous roots in the field. Observations showed that periodic rotting of fibrous roots could occur for some years before the larger roots showed decay; this phase alone sometimes resulted in marked deterioration in the health of the tree, thinning of the canopy, failure to make adequate new growth, poor cropping, and poor

leaf colour. In most instances, lesions on the larger roots result from the spread of infection from fibrous roots and small laterals.

Field and laboratory inoculation experiments showed that of the four citrus varieties used for stock purposes in New South Wales sweet orange is, apparently, the most susceptible, rough lemon rather less so, Seville orange somewhat resistant, and *Poncirus trifoliata* immune.

AVERNA-SACCÁ (R.). **Nectria cancri (Butg.) f. aurantii, Averna.**—*Rev. Agric., Piracicaba*, xvi, 3–4, pp. 150–160, 7 figs., 1941. [Portuguese.]

Two species of *Nectria* cause appreciable damage to citrus in São Paulo, Brazil, viz., *N. cancri* (Butg.) [? misprint for Rutgers] f. *aurantii* Averna on orange and an unidentified species on lemon. The former attacks the vegetative system, including the superficial roots, the stem bases of plants in low-lying, humid sites sustaining particularly severe injury. The infected organs are covered by the delicate white or ashen-grey, cottony or salt-like efflorescence constituted by the conidial (*Fusarium*) stage of the fungus, which ultimately disappears under the influence of cold and damp conditions, to be replaced by a dense, blood-red, granular coating extending over a large part of the invaded area. In some cases the *Nectria* stage is observed on cankers (usually of traumatic origin) on the stem bases.

The *Fusarium* under observation makes good growth on ordinary media, forming cottony, white, later yellow colonies. Sporodochia appear in 12 to 15 days. The falcate, hyaline, tri-, rarely quinqueseptate conidia measure 22 to 37 by 5·5 to 7·4 μ, the thick-walled, round chlamydospores 14 to 18·5 by 14·8 to 22·2 μ, the globular to piriform, cinnabar- or brick-red perithecia, which are covered with uni-, bi-, or tricellular, straight or curved incrustations and furnished with a short, conical, subhyaline, ostiolate beak and hyaline paraphyses, 248 to 648 μ in diameter, the clavate asci 103 to 174 by 18 to 25 μ, and the elliptical, hyaline, thick-walled spores 16 to 28 by 11 to 14·5 μ.

The branches and trunks of lemon trees attacked by the unidentified species of *Nectria* bear ashen-yellow, bright red, or pale brick-coloured pustules of the conidial stage, *Tubercularia vulgaris* [the conidial stage of *N. cinnabarina*]. The perfect stage is stated to differ, however, from *N. cinnabarina* in its larger ascospores (32 to 37 by 16 to 20 compared with 14 to 16 by 5 to 7 μ).

Treatment against both diseases should comprise disinfection of unavoidable wounds with a paste.

Breeding wilt-resistance.—*Indian Fmg*, iii, 8, pp. 442–443, 1942.

Wilt (*Fusarium vasinfectum*) is stated to be much the most important disease of the Indian cotton crop, occurring as it does throughout the Bombay province (except in North Gujerat), in Berar, the western districts of the Central Provinces, the Nizam's Dominions, Northern Mysore, and in parts of the United Provinces and the Punjab. In Bombay the average annual reduction from this source approximates to 5 per cent., but in certain years the damage may amount to upwards of 50 per cent. Among the well-known resistant selections bred by members of various Agricultural Departments are Jayawant, grown in the Karnatak, Jarila in Khandesh, BD 8 in Broach and Verum 434 [*Gossypium neglectum verum*] [*R.A.M.*, xix, p. 15] in the Central Provinces and Berar. In connexion with the Central Cotton Committee's breeding scheme, a technique for the isolation of 100 per cent. resistant types under optimum conditions in a glass-house equipped with temperature controls has been developed at Poona [ibid., xx, p. 256], the selections thus obtained being subjected to further vigorous greenhouse and field testing before their ultimate release for cultivation. Some of the strains originating in the Broach and Jalgaon cotton-growing tracts now comply with all the requirements for full immunity from wilt and are expected shortly to be available for general distribution in Bombay and the neighbouring States.

Prayag (S. H.). **Karnatak Cotton and its improvement.**—*Indian Fmg*, iii, 9, pp. 488–491, 2 pl., 1942.

The highly popular Jayawant (Triumphant) wilt (*Fusarium vasinfectum*) resistant cotton variety [see preceding abstract] is the offspring of two pure strains of Kumpta, Dharwar 1 and Dharwar 2, and dates from 1928. Its wilt mortality percentage (average of three years) was only 0·7 per cent. compared with 5·7 per Kumpta. Another selection from Kumpta combining a high degree of resistance to wilt with heavy yields and superior staple quality is K.F.T. –12–2–5, which has been developed in connexion with the 100 per cent. resistance scheme and tested with satisfactory results at Dharwar and Poona.

Two segregates of a cross between Gadag 1 (a Dharwar-American type) and Co. 2, viz., 4–4–1–1 and 9–7–6–6, are superior to the former parent in resistance to red leaf blight [*R.A.M.*, xvi, p. 97] and other respects.

Staten (G.). **Cottonseed treatments in New Mexico.**—*Bull. N. Mex. agric. Exp. Sta.* 290, 32 pp., 7 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 5, p. 683, 1942.]

In tests at the New Mexico Agricultural Experiment Station with acid-delinted and undelinted cotton seed, normal dosages of several dusts in common use, including new improved ceresan, 2 per cent. ceresan, and spergon, slightly reduced the germination rate, while an excess of the first-named caused a serious retardation and exerted toxic effects on the seedlings. Dusted seed germinated satisfactorily after over a year's storage. Both the ceresan preparations conferred absolute protection against the rotting of seed, whether delinted or not, in cold soil, spergon being almost equally effective for this purpose, while sanoseed and cuprocide were of relatively little value. Spergon, new improved ceresan, and 2 per cent. ceresan proved to be capable of increasing seedling emergence and survival stands, preventing pre-emergence damping-off, reducing the post-emergence phase of the same trouble in some cases, and augmenting the number of healthy plants in soils infested with *Rhizoctonia* [*Corticium solani*].

Ezekiel (W. N.). **Cotton root rot, the weather, and Cotton yields.**—*Trans. Tex. Acad. Sci.*, xxv (*1941*), pp. 63–68, 1 map, 1942.

Many of the observations included in this survey of the relation of weather conditions to cotton root rot (*Phymatotrichum omnivorum*) and crop yields in Texas have been noticed from other sources [*R.A.M.*, xviii, p. 106 *et passim*], but the author's interpretation of the final picture of the influence of rainfall on the host and parasite may be mentioned. Both respond in somewhat the same manner to this factor. Thus, in years of 'favourable' rainfall comparatively high yields may be obtained even in areas where the disease is prevalent, but the output is very much lower than it would be in the absence of the fungus, the development of which is likewise promoted by continuous humidity. In other words, the root rot tends to equalize yields on the particular farms affected at drought level.

Hardy (E.). **Textile mildews.**—*Silk and Rayon*, xvi, 8, pp. 468, 470, 1 fig., 1942.

Fresh samples of raw cotton are stated to have yielded from 4,000,000 to 58,000,000 bacteria and 120,000 to 400,000 moulds per gm., mostly of the soil types which attack cellulose and starch and survive the textile-manufacturing processes in the form of spores. Cotton deterioration in storage is caused by species of *Stachybotrys*, and raw cotton (especially Indian) is the source of much of this infection of cloth. The first sign of mildew is usually a characteristic musty smell, followed by the appearance of greenish, brownish, reddish, yellowish, purplish, or blackish spots due to the presence of *Penicillium chrysogenum*, *Aspergillus niger*, *A. versicolor*, *A. wentii* [*R.A.M.*, xxii, p. 64], *Fusarium* spp., and *Mucor* spp., respectively. Acidity stains are produced on dyed material by *A. fumigatus*, *A. niger*, *P. chrysogenum*, and *Rhizopus arrhizus*.

Cellulose-decomposing species responsible for tendering of cotton include the foregoing, *A. glaucus*, *A. versicolor*, and *A. terreus*, while *A. brunneofuscus*, *A. clavatus*, and *A. fumigatus* will attack the pure cellulose fibres of cotton under suitable moisture conditions and in the presence of inorganic salts.

Well-washed wool requires an atmospheric humidity of 97 per cent. to encourage mildew, but a far lower concentration permits its growth in the case of an impure commercial product, while cotton is also susceptible, e.g., to *A. glaucus*, at a point much further removed from saturation. Most mildews thrive at 25° C., while *A. fumigatus* continues to grow at 37°. The *Penicillium* and *Mucor* spp. generally flourish at lower temperatures than the *Aspergilli*, and are thus less prevalent on tropical material. Shirlan is stated to be the most efficient antiseptic at present known to the cotton industry. Some of the most effective of the 135 chemical treatments devised by the United States Department of Agriculture for the mildew-proofing of cotton fabrics are a cation (plus charge) active softener, followed by a synthetic resin, methyl methacrylate; acetone, formalin, and soda ash; wax and aluminium acetate; catechu copper sulphate and ammonium hydroxide; copper propionyl acetate; and cadmium chloride followed by borax. Sodium pentachlorphenate (santobrite) is an effective and cheap preventive of mildew, while of recent years successful use has also been made of non-toxic higher tertiary alkyl phenols, e.g. abracide, which inhibited cellulose moulds at 1 in 6,000 and *M. mucedo* and *A. glaucus* at 1 in 4,000, and is supplied in a 5 per cent. solution made up in a 10 per cent. potash castor oil soap solution, used in conjunction with 10 per cent. ethylene glycol.

The chemical changes produced by textile mildews are very far-reaching, *P. glaucum*, for instance, having been shown to secrete at least 12 enzymes which decompose the carbohydrates and proteids of the size and produce organic acids tending, in association with a powerful simultaneous reducing action, to destroy the coloured ground of printed goods. Under optimum conditions during manufacturing *Mucor* moulds may proceed from germination to fructification in 24 hours.

UPHOF (J. C. T.). **Ecological relations of plants with ants and termites.**—*Bot. Rev.*, viii, 9, pp. 563–598, 1942.

Among the aspects included in this survey of the ecological relations of plants with ants and termites may be mentioned 'the fungus-growing habit among ants and termites', 'ant-fungi', and 'termite-fungi'. The bibliography of 193 titles comprises a number dealing with the mycological side of the symbiotic connexion between fungi and insects, some of which have already been noticed in this *Review* [*R.A.M.*, xiv, p. 167; xix, p. 405; xx, p. 257].

DRECHSLER (C.). **Two zoophagous species of Acrostalagmus with multicellular Desmidiospora-like chlamydospores.**—*J. Wash. Acad. Sci.*, xxxii, 11, pp. 343–350, 2 figs., 1942.

In continuation of his researches on predaceous fungi parasitic on eelworms [*R.A.M.*, xxi, p. 488], the author gives full descriptions of two new species of *Acrostalagmus*, namely, *A. gonioides* and *A. tagenophorus*, the former destroying *Bunonema* nematodes in leaf mould at Arlington, Virginia, and the latter preying on rotifers in rich soil in Washington, D.C., and in decaying watercress leaves near Woodstock, Virginia. Both species are characterized by terminal, flat, short-stalked, multicellular, yellowish-brown chlamydospores, 12 to 30 by 6 to 15 μ in *A. gonioides* and 5 to 25 by 2 to 3 μ in *A. tagenophorus*, presenting striking analogies with those described by Thaxter (*Bot. Gaz.*, xvi, pp. 201–205, 1891) as typical of *Desmidiospora myrmecophila*.

COUCH (J. N.). **A new fungus on Crab eggs.**—*J. Elisha Mitchell sci. Soc.*, lviii, 2, pp. 158–162, 2 pl., 1942.

A full description, with a technical diagnosis [in English only], is given of *Lagenidium*

callinectes n. sp., a parasite on blue crab eggs (*Callinectes sapidus*) at East Lynnhaven, Virginia. Infection is contracted by means of the zoospores, which germinate on the surface of the egg and send into the interior a germ-tube, the originator of a branched sparsely septate mycelium, eventually almost filling the egg. A sporangium may be formed from each segment of the mycelium. The end of a thread from a segment grows against the egg wall to form a clavate structure from which a fine hypha is pushed through the wall and grows into a large cylindrical tube. The tip of the tube gelatinizes and swells to form a spherical mass into which granular protoplasm flows. Ultimately the vesicle bursts and liberates the zoospores. Spherical resting bodies are formed in old eggs. Attempts to secure pure cultures were unsuccessful. The incidence of infection in the material examined amounted to some 2·5 per cent.

WHITE (R. T.) & DUTKY (S. R.). **Co-operative distribution of organisms causing milky disease of Japanese Beetle grubs.**—*J. econ. Ent.*, xxxv, 5, pp. 679–682, 1942.

With a view to the acceleration of the natural spread of the organisms responsible for the milky disease of Japanese beetle (*Popillia japonica*, Newm.) grubs (*Bacillus lentimorbus* and *B. popilliae*) [*R.A.M.*, xxi, p. 78], the Bureau of Entomology and Plant Quarantine has undertaken an extensive colonization programme in co-operation with the appropriate agencies in 11 States and the District of Columbia. At the time of writing (November, 1942), nearly 21,000 acres, comprising 25,593 colony sites, in heavily infested areas had been treated with the disease-producing bacilli, and furthermore, 260 experimental plots, distributed in seven States and the District of Columbia and covering 92 acres, serve as points of local dispersion.

FERREIRA (L. A.). **Problemas de micologia médica em Moçambique.** [Problems of medical mycology in Mozambique.]—*Bol. Soc. Estud. Colón. Moçambique*, x, 44, pp. 33–64, 7 figs., 1941.

This is a comprehensive account of the etiology, geographical distribution, mode of infection, pathological anatomy, clinical development, diagnosis, and therapy of sporotrichosis, associated in Mozambique with *Sporotrichum schenckii*. The paper includes keys to the family Sporotricheae and the genus *Sporotrichum* and an explanatory survey of the application of Beijerinck's auxanographic method of identification to the yeasts.

Propionate salts as mould inhibitor.—*Nat. Butt. J.*, xxxiii, 6, p. 16, 1 fig., 1942.

Directions are given for the incorporation of propionate salts [*R.A.M.*, xx, p. 173, *et passim*] in butter and cheese at various stages of processing. For 'dry wrapping', parchment paper impregnated with a sufficient quantity of the disinfectant for mould retardation is supplied by the manufacturers, but for 'wet wrapping', e.g., for lining tubs or print wraps, the parchment should be soaked just before use in a solution containing about 20 oz. of the salt per gal. water. In cream cheese, the fungicide may be added either to the 'cold' or 'hot pack', the concentration recommended being $2\frac{1}{2}$ oz. per 100 lb. for spraying or sprinkling in during mixing of the 'cold pack' or 3 to 6 oz. if the solution is added to the undrained curd before bagging. In the case of the 'hot pack', the best results are obtained by the addition of $2\frac{1}{2}$ oz. of the inhibitor during the last five minutes of cooking. The mould-retardant may be added to cottage cheese at the above-mentioned rate at the same time as regular salt. Cut Cheddar cheese need only be immersed for 15 seconds in a solution of the salts to extend the mould-free period from 300 to 400 per cent.—a point of some importance in the light of a large chain grocery's report that losses from this source in cheeses of the Cheddar type range from 8 to 12 per cent. of the total sales.

Skok (J.). **Some mineral deficiency symptoms in plants.**—*Trans. Ill. Acad. Sci.*, xxxiv, 2, pp. 78–81, 1 fig., 1941.

A detailed description, accompanied by statistical data in tabular form, is given of the symptoms induced by deficiencies of nitrogen, calcium, potassium, phosphorus, magnesium, sulphur, boron, and iron in *Petunia hybrida* (Rosy Morn), *Salvia spendens* (Scarlet Dragoon), and *Phlox drummondii* in laboratory experiments at the University of Chicago.

Blanton (F. S.) & Haasis (F. A.). **Insect transmission of the virus causing Narcissus mosaic.**—*J. agric. Res.*, lxv, 9, pp. 413–419, 1942.

When 15 species of insects and two of mites were allowed to feed on mosaic Sir Watkin narcissus [daffodil: *Narcissus pseudonarcissus*] plants [*R.A.M.*, xx, p. 206] and were then transferred to healthy narcissus maintained in cages in the greenhouse and the field, positive results were obtained with all seven species of aphids tested, viz., *Macrosiphum solanifolii* (152 out of 403 plants infected), *M. rosae* (89 out of 136), *M. pisi* (24 out of 31), *Aphis rumicis* (398 out of 605), *Myzus convolvuli* (210 out of 324), *M. cerasi* (15 out of 36), and *Anuraphis roseus* (13 out of 18), control tests with aphids transferred from one healthy plant to another yielding 10 out of 230, 2 out of 54, 14 out of 226, and 9 out of 140 for the first, second, fourth, and fifth species, respectively. *Macrosiphum solanifolii, M. pisi, Anuraphis roseus,* and *Aphis rumicis* have been collected on narcissus plants growing in the field, but only *M. solanifolii* was able to multiply on these plants.

The aphids transmitted the virus to 904 out of 1,558 plants of the Sir Watkin, King Alfred, Minister Talma, Spring Glory, and Victoria varieties. Symptoms appeared in the season following inoculation, and were characteristic of the disease as found on naturally infected plants of the same variety growing in the field.

Kirchner (H. A.). **Grauschimmel an Gartenwicken-Blüten.** [Grey mould on Sweet Pea flowers.]—*Kranke Pflanze*, xix, 3–4, pp. 33–35, 1 pl., 1942.

For the first time in 1940, and again to a slighter extent in 1941, the writer observed an attack on sweet pea flowers at the Rostock Agricultural Experiment Station by the grey mould (*Botrytis cinerea*), the varieties affected being the lavender-blue Austin Frederick and the salmon Hallmark Pink. The spots produced by the pathogen on the petals were colourless and ring-shaped. Infection did not spread to the pedicels until late in the season. The flowering period in 1940 fell at the end of July and beginning of August, when cool and very showery weather prevailed.

Salikov (M. I.). К экологии гриба **Stachybotrys alternans**—,,виновника'' стахиботриотоксикоза Лошадей. [The ecology of the fungus *Stachybotrys alternans*, responsible for poisoning of Horses.]—*Советская Ветеринария* [*Sovetsk. Vet.*], xvii, 6, pp. 53–56, 2 figs., 1 graph, 1940.

Strachybotrys alternans, which recently caused fodder poisoning in the U.S.S.R. [*R.A.M.*, xxii, p. 65], is favoured by excessive moisture and by temperatures of between 20° and 25° C., although tolerating a range of 5° to 40°. The infection is spread by direct contact and by means of air-borne spores. The infected straw and stubble turn dark grey or almost black, the spores appearing like black soot on the stems. In cases of weak infection the fungus is chiefly localized near the stem nodes. For control of the fungus, it is recommended that straw and hay ricks be made in dry weather and on clean sites, and that fields be kept clear of heaps of weeds or straw and stubble.

Neill (J. C.). **The endophytes of Lolium and Festuca.**—*N.Z.J. Sci. Tech.*, xxiii, A, 4, pp. 185–193, 1941.

Further studies are described in the endophytes and related fungi of grasses in New

Zealand [*R.A.M.*, xix, p. 477]. In culture the endophyte of *Lolium perenne* forms white, later dusky pink, pulvinate, gelatinous-waxy sporodochia 0·5 to 1·5 mm. in diameter, consisting of a central core of branching conidiophores, each about 4·5 μ in diameter, with secondary branches measuring 6 to 18 by 3 to 4 μ and bearing tubular sterigmata measuring 12 to 23 by 2 μ. The hyaline, continuous, smooth, elliptical conidia, which measure 2·3 to 3·2 by 1·5 to 2 μ, are produced in succession by budding from the protoplasm of the sterigmata. After the first conidium has ruptured the apex, the outer membrane of the sterigma remains as an open tube, in which more conidia form and through the orifice of which they are discharged. A mucilage discharged with the conidia binds the whole into the sporodochial form. The whole sporodochium closely agrees with *Endoconidium temulentum* [ibid., xxi, p. 2].

A sparse development of structures that may be macroconidia was observed in culture. They closely resemble the *Sphacelia* conidia of *Claviceps*, being hyaline, smooth, continuous, cylindrical with hemispherical ends, measure 5 to 8 by 3 to 4 μ, and usually show two refractive globules. As a rule, they occur in small groups budded from short lateral sterigmata measuring 8 to 15 by 2 μ, but they also arise singly as terminal or lateral buds.

Numerous unsuccessful attempts were made to infect endophyte-free *L. perenne*, *L. italicum*, and *L. temulentum* with the fungus from pure culture by direct inoculation. No transmission occurred by contact when six endophyte-free seedlings were grown in boxes between infected plants for nine months. One positive result was, however, obtained, which may be significant: fresh apothecia of *Lolium* fungus No. 2 (Neill and Hyde, 1940) were planted on the host plants on the surface of eight pots of soil. Short lengths of ½ in. pipe led from the drainage holes to the soil surface, and through these were taken three spikes of endophyte-free rye grass just beginning to flower, the whole being covered with a lamp-chimney with double muslin cover. The seed from the three enclosed spikes and that from the remaining spikes was harvested separately and sown in pots of sterilized soil, the resultant seedlings being examined for the presence of the endophyte. From seven of the plants 246 seedlings from the enclosed, and 244 from the check, spikes were examined, and found to be endophyte-free. From the eighth plant, however, 37 seedlings raised from the enclosed spikes yielded two with typical endophytic hyphae, 53 seedlings from the check spikes yielding none. No ergot developed on the enclosed spikes, though most of the check spikes became infected. If *Lolium* fungus No. 2 is the apothecial stage of the endophyte, it is hard to explain the widely different appearance and physiology of the two fungi in culture.

Tall fescue (*Festuca arundinacea*) and meadow fescue (*F. elatior*) in New Zealand normally contain an endophyte which in culture on most media forms a slowly spreading, white, sublanose mat, the surface of which soon breaks into blisters and folds. Conidia appear singly, budded from the apex of short tapering sterigmata, measuring 12 to 25 by 1·5 μ at the base, which branch perpendicularly at intervals from trailing aerial hyphae. Before the conidium matures a drop of mucilage appears at its apex; at maturity, this mucilage appears to assist abstriction by flowing down the lower surface, gumming the conidium at right angles to the apex of the sterigma when abstriction is complete. These conidia are hyaline, continuous, somewhat irregularly elliptical, and measure 6 to 8 by 2 to 3 μ. In dry, old cultures the conidia tend to be curved, with attenuated extremities, and may attain a length of 11 μ. The conidial apparatus is identical with that described for *Epichloe typhina* [ibid., xiv, p. 766], but the conidia are rather larger. If the New Zealand *Festuca* endophyte is a strain of *E. typhina*, it must have permanently lost the ability to produce asci or prevent flowering of the host.

Data from 11 samples of New Zealand tall fescue seed indicated that endophyte-free plants are produced by infected seed if twelve months at least have elapsed since harvest.

Johansson (E.). **Nyare undersökningar på fruktodlingens område.** [Recent investigations in the sphere of fruit cultivation.]—*Sverig. pomol. Fören. Årsskr.*, xlii, pp. 17–32, 1941.

The following items occur in this survey. In August, 1941, apples from the north of Scania showing typical symptoms of internal cork were received at the Swedish State Experimental Nursery, Alnarp. In *Norsk Havetid.*, p. 95, 1941, K. A. Hjeltnes reports that in the spring of 1937 Charlamovsky and Antonovka apple trees suffering from boron deficiency in Norway were supplied with borax at the rate of 0·8 kg. per 100 sq.m. During the harvest of 1939, 600 fruits were examined, half from a treated tree, and the remainder from an untreated: symptoms of boron shortage were apparent in 3 per cent. of the former and in 77 per cent. of the latter.

Tiller (L. W.). **Orchard storage of Apples.**—*Orchard. N.Z.*, xiv, 4, pp. 68–69, 71, 1941.

The consumption within New Zealand of apples normally exported is necessitated by war conditions. Refrigerated space being restricted, the possibilities of orchard storage were investigated. Four types of improvised stores were tested, the coolest and most successful proving to be an excavation in a bank, with a floor of shingle and a roof of straw thatch over wire netting, ventilation being provided.

The Statesman variety kept better in the orchard than in cold storage, and Tasma sustained practically no loss. Damage to Sturmers was chiefly due to wilt, but this was prevented by the use of waxed paper case linings, and much reduced by plain newsprint. Granny Smith and Washington could be stored for only a short time, being very susceptible to ripe rot. Ballarat apples required dry air conditions, and then kept well, but showed better ground colour—an important feature—in cold storage. Dougherty also developed ripe rot in a moist atmosphere, and there was an appreciable amount of slight superficial scald in this variety. Rome Beauty and Rokewood were affected by mealiness and severe breakdown.

Cunningham (G. H.). **Research work on ripe-spot of Apples.**—*Orchard. N.Z.*, xv, 6, p. 2, 1942.

The fungus isolated from 95 per cent. of the cultures from the brown or black, sometimes pink-bordered, sunken spots on different varieties of New Zealand apples was identified as *Neofabraea malicorticis* [*R.A.M.*, xiii, p. 523], inoculation with which into sound fruits resulted in the typical symptoms of ripe rot. Factors tending to increase the development of the disease in storage include late picking, retention in the shed after picking, and unduly high storage temperatures. The results of orchard experiments indicate that a reasonable degree of ripe rot control, without appreciable injury to the foliage or fruits, may be secured by three applications of Bordeaux mixture, (1) at 1–3–100 in early January, (2) at 2–6–100 in mid-February, and (3) as for (1) in the third week of March, $\frac{1}{4}$ lb. casein and $\frac{1}{4}$ lb. hydrated lime per 100 gals. spray being added in each case.

Shaw (F. R.) & Bourne (A. I.). **Some observations on the effects of sulphur compounds applied during bloom on Bee behaviour.**—*J. econ. Ent.*, xxxv, 4, pp. 607–608, 1942.

The results of preliminary experiments in Massachusetts indicated that sulphur applied to Arkansas apple blossoms during the flowering period, either in the form of a 400-mesh dust or in that of a 1 in 50 lime-sulphur solution, for the control of scab [*Venturia inaequalis*], reduced the number of bee visits [*R.A.M.*, xvi, p. 188]. Nine trials were conducted between noon and 4 p.m., during which period the average numbers of bee visits to the untreated, sprayed, and dusted blossoms were 197, 95, and 48, respectively, the corresponding averages per test and per minute being 21·8, 10·5, and 5·3, and 2·18, 1·05, and 0·53, respectively. Considering that the rainy conditions

favouring severe scab tend in themselves to depress the activity of the insects, the wisdom of applying repellants to the trees at this juncture is questionable.

Powell (D.). **How do codling moth sprays affect scab control?**—*Illinois Hort.*, xxxi, 3, pp. 1–3, 1942. [Abs. in *Hort. Abstr.*, xii, 4, p. 197, 1942.]

The effect of codling moth [*Cydia pomonella*] sprays on scab [*Venturia inaequalis*] control on a 20-acre block of Delicious apples was investigated by the Illinois Natural History Survey in 1940–1. The plot receiving five lead arsenate-dilute Bordeaux treatments at intervals from 8th May to 12th June showed 4·5 per cent. infection on 16th September compared with 68 per cent. in the untreated controls. Other spray combinations gave less satisfactory results. In the following spring the percentages of dead leaves bearing perithecia under the trees were 2 for the lead arsenate-Bordeaux spray and 31 for the controls, the figures for infection of green foliage being 4 and 61, respectively. The conclusion is reached that more attention should be paid to scab control in late summer, that the codling moth spray schedules assist in the suppression of the fungus, and that late-season applications greatly facilitate control in the following spring.

Rolfs (F. M.). **Apple blotch.**—*Bull. Okla. agric. Exp. Sta.* B-261, 15 pp., 4 figs., 1942.

This is a semi-popular account of the history, distribution, symptoms, etiology, modes of dissemination among seedling, nursery, and orchard trees, and control of apple blotch (*Phyllosticta solitaria*), specimens of which were first collected by L. M. Underwood on crab apple in Indiana in 1893 (*Proc. Ind. Acad. Sci.*, pp. 144–156, 1894), the earliest record for Oklahoma dating from 1908 (*Bull. Okla. agric. Exp. Sta.* 76) and the present area of infection extending from New Jersey and Georgia to Nebraska and Texas. Under Oklahoma conditions the most susceptible cultivated apple varieties are Arkansas Black, Ben Davis, Cooper's Early, Duchess, Fameuse, Gano, Huntsman, Maiden Blush, Mann, Missouri Pippin, Oliver, Rome Beauty, Roman Stem, Shockley, Smith Cider, Stark, and White Winter Pearmain, a considerable degree of resistance being shown by Delicious, Early Harvest, Grimes Golden, Ingram, Jonathan, Ralls Genet, Red June, Stayman Winesap, Starking, Wealthy Winesap, Yellow Transparent, and York Imperial. Pears are also liable to infection by *P. solitaria.*

Dissemination from old, forgotten trees takes place by means of pycnospores carried by wind and rain, while infected leaves from such trees may also be washed away in the run-off water or blown considerable distances by the wind. The radius of infection for wind-blown raindrops from a tree 30 ft. high is about 240 ft., with 100 per cent. contamination in the first 40 ft. area. The degree of spread diminishes with distance from the tree, but the area involved usually becomes greatly and irregularly extended by infection carried in run-off water and wind-blown leaves. In Oklahoma the sweating process of dealing with seedling trees used as stocks also serves to spread infection. Young trees are lifted in October, placed slanting in bundles in rows in a shallow bed, covered with soil until December, and then lifted ready for grading and packing. The close contact and mixing of the bundles afford ample opportunity for direct infection of stems and roots, especially if the sweating is unduly prolonged.

Control should be based on the stringent exclusion of the pathogen from seedling and nursery material, a planting site at least half-a-mile from any centre of the disease being chosen, supplemented by regular spraying with Bordeaux mixture.

Huelin (F. E.) & Tindale (G. B.). **Investigations on the gas storage of Victorian Pears.**—*J. Dep. Agric. Vict.*, xl, 11, pp. 594–606, 3 figs., 2 graphs, 1942.

In further investigations into the storage of pears in Victoria [*R.A.M.*, xvii, p. 468]

carried out from 1938 to 1940, continuous gas storage (at 32° F.) in 5 per cent. carbon dioxide and 16 per cent. oxygen increased the storage life of William's Bon Chrétien, Bosc, and Winter Cole by about 100 per cent., that of Packham and Winter Nelis by about 30 per cent., and that of Josephine pears by less than 10 per cent. Even better results were obtained with a storage atmosphere containing 10 per cent. carbon dioxide and 11 per cent. oxygen, but there was serious risk of damage through hard heart. This new type of wastage (the term 'hard heart' is used in preference to 'brown heart', which may cover any kind of internal discoloration) is characterized by a sharply defined area of hard, probably dead, tissue including the core and extending to some or most of the surrounding flesh, the affected area being sometimes, but not invariably, discoloured. Hard heart was frequently observed in pears stored in atmospheres containing 10 per cent. or more of carbon dioxide, particularly when gas storage was preceded by air storage. Another new disorder, described as a type of lenticel scald and observed mainly in pears placed in gas storage after about six weeks in air, appeared, upon removal of the pears from storage, as somewhat diffuse spots around the lenticels, later extending and merging into lesions similar to those of ordinary scald, but lighter in colour and more blotchy. Continuous gas storage gave better results than gas storage preceded or followed by air storage. Bosc pears kept for three months in air prior to gas storage became liable to injury even in an atmosphere containing only 5 per cent. carbon dioxide, whereas exposure of the same variety to high concentrations of carbon dioxide (20 per cent. falling to 13 per cent.) for about a week caused no injury. A picking of William's Bon Chrétien pears proved much more liable to hard heart in an atmosphere containing 10 per cent. carbon dioxide and 11 per cent. oxygen than one made 10 to 14 days earlier. Gas storage was found to retard colouring of the fruits, the results indicating that the rate of colouring is largely a function of the concentration of oxygen. Pending further trials, it is tentatively suggested that an initial period in 10 per cent. carbon dioxide and 11 per cent. oxygen preceding storage in 5 per cent. carbon dioxide and 16 per cent. oxygen may give the best results.

HILDEBRAND (E. M.), BERKELEY (G. H.), & CATION (D.). **Handbook of virus diseases of stone fruits in North America.**—*Misc. Publ. Mich. agric. Exp. Sta.*, 76 pp., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 5, p. 691, 1942.]

One of the results of a conference held at the Michigan State College in 1941 to discuss the problem of the stone fruit virus diseases, which have gradually been assuming an acute form in the United States, was the selection of a committee to collect and classify both published and unpublished data on the nomenclature, symptoms, host range, geographical distribution, and other features of this group of disorders. The object of the present handbook is the immediate circulation of an up-to-date summary of the available information on the viruses in question, including some not hitherto reported.

MCWHORTER (O. T.). **Peach twig blight hits orchards hard.**—*Bett. Fruit*, xxxvii, 4, p. 3, 1942.

Peach orchards in Oregon were severely damaged in 1942 by twig blight [*Clasterosporium carpophilum*] and brown rot [*Sclerotinia laxa* and *S. fructicola*], recommendations for the control of which (likewise effective against curl [*Taphrina deformans*]) in the Willamette Valley during the dormant period include (1) removal before leaf-fall of all dead twigs killed by the fungi to destroy the sources of infection within the tree; (2) thorough spraying, before the onset of the autumn rains, with a 4–4–50 Bordeaux mixture to forestall the activities of *C. carpophilum*; and (3) an anti-leaf curl treatment of 6–6–50 Bordeaux plus 1 pint to 1 quart summer oil before the swelling of the winter buds (in December).

Lyman (C.) & Dean (L. A.). **Zinc deficiency of Pineapples in relation to soil and plant composition.**—*Soil Sci.*, liv, 5, pp. 315–324, 3 figs., 1942.

A tabulated account is given of an investigation to determine the zinc content of pineapple plants and soils in relation to the observed zinc-deficiency symptoms in the field in Hawaii, the procedures used for these purposes being described in detail. The symptoms of zinc deficiency in the plants appear to fall into two phases, of which the more common and less severe is a mottling and blistering of the upper leaf surfaces, occasionally followed by a mild curvature of the unmottled younger leaves. The results showed an evident correlation between the degree of zinc deficiency exhibited by the plants and the zinc content of the soils in which they were grown. The meristematic tissues showed the maximum concentrations of zinc, and provided figures most closely proportionate to the soil zinc content.

It is concluded from these data that the curative effects of zinc sulphate sprays on pineapple plants affected by the anomalies herein described are a direct outcome of the inability of the soil to provide sufficient zinc for normal growth.

Fellers (C. R.) & Clague (J. A.). **Souring of dried Dates by sugar-tolerant yeasts.**—*Fruit Prod. J.*, xxi, 11, pp. 326–327, 347, 2 figs., 1942.

During the past two years the writers examined at the Massachusetts State College about a dozen samples of sour dates, two imported from Algeria and the remainder consisting of the Hallowi, Sayer, and Khadrawi varieties from Iraq, of which the first-named was the most subject to the defect under investigation and the last almost immune. Cultures of the affected material on nutrient cider agar, date syrup, wort agar, and Gorodkowa's spore medium at a temperature range of 20° to 37·5° C. (optimum 30°) yielded five strains of *Torula* and *Willia anomala* [*R.A.M.*, xi, p. 384]. The cells of *T.* strains A, B, and C measured, respectively, 5·2 to 7·8 by 2·6 to 5·2, 7·8 by 5·2 to 7·8, and 5·2 by 5·2 μ, the characters of D and E being similar. All the yeasts were facultative anaerobes; none liquefied gelatine, induced any significant changes in milk or litmus milk, or fermented lactose, glycerine, silicin, or inulin; fat globules were conspicuous in all the cultures. No souring was produced in dates with a moisture content below 25 per cent., 23 per cent. being proposed as a safe maximum for market fruits. All the organisms were totally destroyed by an hour's pasteurization at 160° F. at a relative humidity of 75 per cent.

Mrak (E. M.), Phaff (H. J.), Vaughn (R. H.), & Hansen (H. N.).—**Yeasts occurring in souring Figs.**—*J. Bact.*, xliv, 4, pp. 441–450, 1942.

From 30 samples of three varieties of souring figs (Calimyrna, Adriatic, and Kadota) from various parts of California, 115 yeasts were isolated [cf. preceding abstract], mostly species of *Saccharomyces* and *Candida*, the former including *S. cerevisiae* (25), *S. tubiformis* (6), *S. fragilis* (2), and one each of *S. cerevisiae* var. *ellipsoideus*, *S. carlobergensis* var. *monacensis*, and *S. c.* var. *polymorphus*, and the latter *C. krusei* (26), *C. chalmersi* (6), and an unidentified species of the *guilliermondi* group. Other organisms concerned in the spoilage of the figs included *Pichia kluyveri* (14), *P. fermentans* and *P. belgica* (one each), *Zygospichia chevalieri* (one), *Hanseniaspora melligeri* (8), *Kloeckera lindneri* (12), *K. africana* (one), *Torulopsis stellata* (6), and single isolates of *Zygosaccharomyces globiformis*, *Hansenula anomala* var. *sphaerica*, and *Debaryomyces dekkeri* n.sp., characterized by spherical to globose cells measuring (in one- and three-day liquid wort cultures) 2·4 to 3·6 by 2·4 to 3·6 (average 3 by 3) μ, and spherical, rough ascospores, 2·9 by 2·9 μ, arising from iso- or heterogamic conjugation in 40-day-old cultures. Glucose, fructose, mannose, sucrose, maltose, and $\frac{1}{3}$ raffinose are fermented, asparagin, ammonium sulphate, urea, and peptone utilized, and good growth made in alcohol. Slant cultures are pale olive-buff, smooth or slightly verrucose, glistening, and convex with entire borders.

The sugar tolerance of the souring organisms was low, most of them growing in 40°, but not in 50° Balling, fig syrup. Their production of volatile and fixed acids was insufficient to cause the defect under observation, which is attributed to the joint action of the yeasts and bacteria (mostly *Acetobacter*), which were isolated from all the samples examined.

Carpenter (J. B.). **A toximetric study of some eradicant fungicides.**—*Phytopathology*, xxxii, 10, pp. 845–856, 1 fig., 2 graphs, 1942.

At the Wisconsin Agricultural Experiment Station the writer investigated the toxicity of elgetol (dinitro-orthocresylate) and three other potential eradicant fungicides, viz., lignasan, a phenyl mercury oleate, and a toluene derivative, to six plant pathogens, i.e., *Venturia inaequalis* from apple [*R.A.M.*, xxi, p. 494], *Cladosporium carpophilum* and *Coryneum beijerinckii* [*Clasterosporium carpophilum*] from peach, *Coccomyces hiemalis* from cherry, *Valsa cincta*, and *Sclerotinia fructicola* from plum. The laboratory experiments were carried out by a modification of the agar-plate method of Schmitz *et al.* [ibid., x, p. 217], and a small-scale study was made of the suppression of the ascospore inoculum of *Venturia inaequalis* in overwintered apple leaves by elgetol.

C. hiemalis proved to be consistently one of the most susceptible of the test fungi, followed in order by either *V. inaequalis* or *Valsa cincta*, the other three being more resistant. The relative susceptibility of the six organisms, however, varied with each eradicant. Under the conditions of the trials, lignasan was the most toxic of the four fungicides, followed in order by the phenyl mercury oleate preparation, elgetol, and the toluene derivative.

Based on equal percentage concentrations of the antiseptic, the toxicity of lignasan was from 3 to 300 times as high as that of any of the other preparations tested, the minimal concentrations required to destroy *Cladosporium carpophilum*, *Coccomyces hiemalis*, *Clasterosporium carpophilum*, *S. fructicola*, *V. cincta*, and *Venturia inaequalis* being 0·0050, 0·0025, 0·0050 and 0·0025 (two isolates), 0·0050 and 0·0075, 0·0050 and 0·0025, and 0·0025 per cent., respectively. All the eradicants except elgetol yielded a toxic vapour at the concentrations tested, an advantage meriting consideration in any interpretation of their relative fungicidal values. Clear-cut specificity of toxic action was shown only by the toluene derivative, which was markedly destructive only to *Coccomyces hiemalis* and *S. fructicola*.

The times required for the death of *V. inaequalis* from exposure to lignasan and elgetol at the maximum concentrations used were three and 24 to 48 hours, respectively. *Clasterosporium carpophilum* was more resistant, and *S. fructicola* more resistant still, to both eradicants.

Elgetol at a strength of 0·5 per cent., applied at the rate of 600 gals. per acre, usually suppressed over 99 per cent. of the ascosporous inoculum of *V. inaequalis* on naturally overwintered Cortland apple leaves in three hours, thereby furnishing additional evidence of the capacity of the fungicide for the rapid arrest of infection at feasible concentrations.

Maier (W.). **Was wissen wir heute von der Chlorose?** [What is the extent of our present knowledge of chlorosis?]—*Forschungsdienst*, xxiv, pp. 149–169, 1942. [Abs. in *Hort. Abstr.*, xii, 4, p. 195, 1943.]

The following types of chlorosis are discussed with special reference to the occurrence of this disorder in German vineyards [*R.A.M.*, xx, p. 391]: (1) inherited chlorophyll defects, as exemplified in *Coleus hybridus*; (2) infectious chlorosis of virus origin; (3) chlorosis caused by insects, fungi, or bacteria; (4), (5), (6), and (7) chlorosis due, respectively, to weather or soil conditions and deficiencies or excesses of water and soil nutrients; and (8) chlorosis in grafted vines.

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VOL. XXII | MAY | 1943

TILLER (L. W.). **Controlling wilt in Winter Cole Pears.**—*Orchard. N.Z.*, xv, 4, p. 13, 1942.

In a test at Wellington, New Zealand, in which half of the 42 cases of Winter Cole pears placed in cold storage on 21st March (two days after picking) were lined with waxed paper, while the individual fruits were wrapped in 'copperized' paper, the remainder being left unlined, only 7 per cent. wilt (mostly slight) developed in the former lot, compared with 49 per cent. (23 per cent. severe) in the latter.

WELLMAN (R. H.) & MCCALLAN (S. E. A.). **An analysis of factors causing variation in spore germination tests of fungicides. IV. Time and temperature.**—*Contr. Boyce Thompson Inst.*, xii, 6, pp. 431–449, 12 graphs, 1942.

In a further contribution to this series [*R.A.M.*, xx, p. 543] toxicity curves were established for copper sulphate, zinc chloride, 'Standard Laboratory Bordeaux', red cuprous oxide, and two synthetic organic chemicals on *Sclerotinia fructicola, Alternaria solani, Glomerella cingulata,* and *Macrosporium* [*Stemphylium*] *sarciniforme* at temperatures of 10°, 15°, 21°, 27°, and 35° C. [ibid., xxi, p. 422]. The counts were made after varying periods from the moment when the spores were first brought into contact with the chemicals, referred to throughout the paper as 'elapsed time'.

It was found that spores of different species did not start germinating at the same time or germinate at the same rate. A linear relation, within limits of experimental error, between reciprocals of elapsed time and germination expressed in 'probits' [ibid., xxii, p. 34] is shown for the spores of all the four species of fungi germinating in water at all the temperatures used. Temperature had a marked effect on the rate of germination of spores of all four species in water, particularly after short periods of elapsed time; all fungi reached 98 per cent. germination or more by 50 hours at all temperatures, except *Sclerotinia fructicola* and *G. cingulata* at 35° where the germination was about 90 per cent. The optimum temperature for germination was between 27° and 35° for *A. solani*, between 21° and 27° for *S. fructicola* and *Stemphylium sarciniforme*, and near 27° for *G. cingulata*. No significant difference in precision was evident between counts made after 6, 12, 24, 48, or 96 hours.

A linear relation between reciprocals of elapsed time and germination expressed in probits was shown to exist when spores are germinated in a given concentration of a chemical, provided the concentration permits germination. The effect of elapsed time in fungistatic tests was found to be the reverse of the usual action of time in toxicity tests at a given concentration. In fungistatic tests the inhibition of germination diminishes as time goes on since the spores continue to germinate and thus give indication of viability. A linear relation is demonstrated for LD50 values by plotting the logarithm of concentration against the reciprocal of elapsed time. This curve is said to be important in the estimation of the potency of a fungistatic agent, since compounds are rated differently at various times on the same fungus, and also because fungi may differ in their relative susceptibility to a single compound, depending on the elapsed time. Slopes of the dosage-response curves [ibid., xxii, p. 72] did not differ significantly for the various elapsed times, provided an appropriate correction was made for control germination.

The effect of temperature was determined by calculating LD50 values of the chemical after 20 hours or more of elapsed time, when the chemical effect had approached an equilibrium with respect to time. No significant difference in LD50 values could be demonstrated at 15°, 21°, or 27°, but there was a temperature effect at 10° and 35°. Compounds were not rated in the same order at 10° and 35°, but in general it took less chemical to give an LD50 value at these extreme temperatures; it took proportionally more chemical to give an LD50 value on *A. solani* at the higher temperatures and on *Sclerotinia fructicola* at the lower temperatures. It is concluded that in spore germination tests, where counts are made after 20 hours or more of elapsed time, temperature need be controlled only within approximately 5° above or below the optimum for spore germination. Generally speaking, time of counting and extreme temperatures are considered to be as important sources of variation in fungistatic tests as is the difference in susceptibility of fungi.

McCallan (S. E. A.) & Wellman (R. H.). **Fungicidal versus fungistatic.**—*Contr. Boyce Thompson Inst.*, xii, 6, pp. 451–463, 4 graphs, 1942.

The fungicidal and fungistatic properties (defined as the ability to kill and inhibit fungi, respectively) of 15 water-soluble chemical compounds were tested on spores of *Sclerotinia fructicola*, *Alternaria solani* [see preceding abstract], *Penicillium expansum*, and *Rhizopus nigricans*. For the fungistatic tests the slide-moist chamber method was employed, ensuring a prolonged contact of spores with the chemicals; in the fungicidal tests the spores were suspended in the chemical solutions for 2·5 to 2,560 minutes, centrifuged, decanted, and washed to remove the chemical, and then allowed to germinate on slides in moist chambers. As, theoretically, the fungicidal activity of a compound cannot exceed its fungistatic activity, the compounds tested could be placed, in respect to all four fungi, in three groups, viz., A, both activities high: this group included silver nitrate, mercuric chloride, sodium hypochlorite, iodine, copper sulphate (except *P. expansum*), crystal violet (except *R. nigricans*), and malachite green (except *P. expansum* and *R. nigricans*); B, both activities low: formaldehyde, acetic acid, phenol, and berberin sulphate; and C, fungistatic activity high and fungicidal activity low: potassium dichromate, uranyl acetate, sodium arsenate, 8-hydroxyquinoline sulphate, copper sulphate (*P. expansum* only), crystal violet (*R. nigricans* only), and malachite green (*P. expansum* and *R. nigricans* only). In a few instances, especially copper sulphate on *S. fructicola*, the addition of a small quantity of ultrafiltered orange juice markedly lowered the fungicidal action. The fungicidal dosage-response curve gave straight lines when plotted on logarithm-probability paper. In many cases, particularly copper sulphate, potassium dichromate, uranyl acetate, sodium arsenate, malachite green, berberin sulphate, and 8-hydroxyquinoline sulphate, the fungicidal curves were decidedly flatter than the corresponding fungistatic ones. Limited data indicated that the fungicidal time-response curves give straight lines when plotted on logarithm-probability paper.

Wilson (J. D.) & Irons (F.). **Specifications of some of the ingredients commonly used in fungicidal dust mixtures.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxvii, 214, pp. 26–41, 4 figs., 1 diag., 1942.

Most dusting equipment works best with applications of 20 to 40 lb. per acre and dilutions with a filter are required to provide an amount of active agent per acre within this range. In order to prepare mixtures it is necessary to know (*a*) the weight-volume relationship and (*b*) the flowing qualities of the different ingredients. A tabulated account is given of the standardized methods of procedure adopted at the Ohio Agricultural Experiment Station to determine the weight (*a*) per cu. ft. and (*b*) per cu. in., particle size, rate of flow, and hydrogen-ion concentration of various fixed coppers and the diluents or carriers and adhesives used as ingredients of these fungicidal dusts [*R.A.M.*, xxi, p. 32]. The weight per cu. ft. was determined by means of a cu. ft.

measure filled in a standard manner, and the weight per cu. in. with a Scott volumeter. The weights per cu. ft. of the diluent materials ranged from 9 lb. for celite to 67 lb. for 325-mesh whiting, with an average of 30 to 45 lb., the corresponding values per cu. in. being from 1·32 to 12·12 (4 to 7) gm., respectively. The weights of the fixed coppers ranged from 26 lb. per cu. ft. for COC-S to 96 lb. per cu. ft. for cuprocide, and from 4·41 to 17·45 gm. per cu. in., respectively. The size of the average particle, measured by means of a filar micrometer attachment on a microscope, varied between about 2μ in 325-mesh bentonite to nearly 30μ for many of the talcs, gypsum, and similar substances. Most of the particles were of the granular type, and thus passed more easily through the 44μ openings between the wires of a 325-mesh screen than would fibrous or flaky materials. The rate of flow of the different samples through Peerless (hand) and Messinger (power) dusters varied considerably with their weight-volume ratios, particle size and shape, friction coefficients, &c., those composed of fibrous particles generally being the slowest and those of coarser texture the most rapid in movement. Most of the preparations were moderately alkaline (P_H8 to 9·3), hydrated lime being extremely so (12·25); pyrax and ABB talc, Cherokee and Perry clays, wheat and soya flours, and phosphate rock showed varying degrees of acidity.

Nielsen (L. W.) & Williamson (C. E.). **The composition and field performance of some silver sprays.**—*Phytopathology*, xxxii, 11, pp. 1027–1030, 1942.

At Cornell University, Ithaca, New York, the writers conducted experiments from 1938 to 1940 to determine the efficacy of three silver sprays in comparison with Bordeaux mixture for the control of potato and celery late blights (*Phytophthora infestans* and *Septoria apii*, respectively), and tulip fire (*Botrytis tulipae*). The composition of the silver sprays was as follows: (1) silver nitrate and sodium lauryl sulphate (as 'dreft') at concentrations of 0·299 to 1·195 and 6·3 to 7·5 gm. per gal., respectively; (2) silver nitrate-ferrous sulphate-hydrated lime (0·598, 0·98, and 0·59 gm. per gal., respectively); and (3) silver nitrate-manganous sulphate-lime (0·598, 0·77, and 0·59 gm. per gal.). There was no significant difference between the silver sprays and Bordeaux mixture (4–4–50) as regards the control of celery late blight, while the former were less effective than the latter (5–2·5–50) in the elimination of *P. infestans*. However, both the silver-lauryl sulphate and the silver-manganous sulphate mixtures combated tulip fire as efficiently as Bordeaux (1·5–4·5–50) in one season's trials. The fact that none of the silver sprays left any objectionable deposit on the treated foliage suggests their potential value as fungicides for certain copper-sensitive plants.

Martin (H.), Wain (R. L.), & Wilkinson (E. H.). **Studies upon the copper fungicides. V. A critical examination of the fungicidal value of copper compounds.**—*Ann. appl. Biol.*, xxix, 4, pp. 412–438, 2 graphs, 1942.

The germination of fungal spores (mainly of *Macrosporium* [*Stemphylium*] *sarciniforme*, but in some trials also of *Venturia inaequalis* and *V. pirina*) exposed to known concentrations of different copper compounds was examined at the Long Ashton Research Station [*R.A.M.*, xvii, p. 260] by either placing the spore suspensions on the deposits obtained by drying sprayed cellulose slides or by mixing them with solutions of the copper compounds on unsprayed slides.

Linear relationships were obtained between the logarithm of the copper concentration and 'probit' [ibid., xxii, p. 145] germination. Since the results in most trials fell on a single line, it was possible to define fungicidal value by two statistics: (*a*) the slope of the line or the regression coefficient, and (*b*) the position of the line or the median lethal dose, the former affording a measure of the inherent toxicity of the fungicide which is largely independent of the particle size of the material, and the latter a measure of the availability of the compound determined by physical factors such as particle size. Sometimes the probit germination points fell on lines of different slope; this happened when (*a*) germination at the lowest concentrations was less or (*b*) greater

than would be expected if the probit germination-dosage curve were a single line, or when (*c*) germination at the highest concentrations was less than would be expected for a single line.

On the assumption that case (*a*) may be explained by the necessity to reach a critical concentration before the mortality-dosage curve becomes normally distributed, and cases (*b*) and (*c*) by the presence, in the spore droplet, of two toxicants of dissimilar action, the results obtained are taken to indicate that a wide group of copper compounds, including cupric chloride, dinitrocresylate, phosphate, sulphanilate, sulphate and sulphide, cuprous oxide (yellow), and Bordeaux and Burgundy mixtures, possess a common regression coefficient attributable to the cupric ion; that basic derivatives such as the basic sulphate, chloride, carbonate, and fluoride yield regression coefficients smaller than that of cupric ion in the approximate ratio 1 : 1 : 2 : 2 (?) : 4; and that derivatives in which co-ordination with the formation of complex ions can occur may exhibit more than one regression coefficient, a trend which can be correlated with the stability of the complex ion. This last conclusion is illustrated by the fact that among the salts of dibasic carboxylic acids, the oxalate usually, and the malonate sometimes, showed regression coefficients lower than that of the cupric ion, whereas the succinate in all tests yielded the same regression coefficient as the cupric ion; of the amino-acid salts, the glycinate frequently yielded the cupric ion slope, the alaninate rarely, the valinate less rarely, and the leucinate yielded only a regression coefficient, which is general among complex amino-cupric derivatives, such as tyrosinate, phenylalaninate, cystinate, aspartate, and glutamate. The copper salts of the hydroxy-acids, lactic, malic, tartaric, and mucic acids, generally yielded regression coefficients of the same order as copper sulphate, but results with cupric malate, sodium and cupric cuprimalates indicated a component of steeper slope. Copper co-ordinated to ethylenediamine gave a lower regression coefficient than that of the cupric ion, the dinitrocresylate being so little toxic that its regression coefficient could not be established. The copper derivative of ethylenediamino-*bis*-acetylacetone exhibited the same regression coefficient as that of the cupric ion, while cupric sebacate, phthalate, and, in one test, the hippurate, yielded steeper lines than that due to the cupric ion, indicating the high inherent toxicity which can be associated with the undissociated molecule. In addition to ethylenediaminocupric dinitrocresylate, the basic arsenate, cupric ferrocyanide, quinaldinate, the copper salt of salicylaldoxime, cuprous iodide, and thiocyanate may be classified as non-fungicidal to the spores tested, this being associated with the high degree of stability and insolubility of these compounds.

On the basis of these results the following hypotheses are proposed concerning the mode of toxic action: (*a*) in the case of Bordeaux and Burgundy mixtures and most relatively insoluble derivatives yielding the regression coefficient of the cupric ion, it is solution by the spore exudate by complex ion formation yielding cupric and complex ions of which the cuprimalate is that of most direct toxicity; (*b*) in the case of soluble derivatives readily yielding cupric ions, it is interaction with spore exudate, fungicidal action operating as in (*a*); (*c*) in the case of yellow cuprous oxide, it is decomposition by which half the copper reaches the spore by the cupric ion route; (*d*) in the case of red cuprous oxide, cupric oxide, basic copper compounds, and the complex amino-acid derivatives fungicidal action seems to follow a more complicated series of reactions the nature of which is as yet unknown; and (*e*) in the case of sebacate and phthalate the undissociated molecule may be directly fungicidal, an action independent of cupric ion formation.

HOFFMAN (C.), SCHWEITZER (T. R.), & DALBY (G.). **The fungistatic properties of pyridine carboxylic and aminobenzoic acids, a resonance effect.**—*J. Amer. pharm. Ass.*, xxxi, 4, pp. 97–99, 1 graph, 1942.

In further studies at the Ward Baking Company, New York, on the toxicity of benzoic acid and related compounds to a number of common food spoilage moulds,

including *Aspergillus niger*, *A. glaucus*, *Rhizopus nigricans*, and *Penicillium frequentans* [*R.A.M.*, xix, p. 667] on nutrient agar containing 1 per cent. sucrose at 37·5° C., the ortho-pyridin carboxylic (picolinic) acid showed fungistatic properties, which did not, however, equal those of benzoic acid [cf. ibid., xxi, p. 334]. The ortho-aminobenzoic (anthranilic) acid is slightly less potent than benzoic, while the meta-aminobenzoic acid is a very weak inhibitor of mould growth and nicotinic and isonicotinic acids are without effect. The molar concentrations of benzoic acid necessary for the inhibition of fungal development at P_H2, 5, and 6 were found to be 0·0016, 0·0074, and 0·0532, respectively. The bearing of these data on the relationship between fungistatic capacity and molecular structure in the benzene ring nucleus is briefly discussed.

Polunin (N.). **High-concentration hydrogen cyanide fumigation of fungi and bacteria.** —*Nature, Lond.*, cl, 3815, p. 682, 1942.

When two rooms of the Druce Herbarium at Oxford were fumigated for 50 hours with gaseous hydrogen cyanide in a concentration of over 30 mg. per l. (about 2·6 per cent. 'by vol.'), growth was arrested in exposed Petri dish cultures of *Penicillium frequentans*, *Aspergillus* sp., or [unidentified] fungi and bacteria obtained by exposing for 10 minutes agar plates in the same rooms before fumigation; and no growth occurred on sterile exposed plates for ten days, after which time slight growth developed on some of them. It is concluded that the colonies were killed by the fumigant and malt agar plates rendered temporarily or permanently inhibitant to the growth of organisms present in the air of the rooms, though it was not determined whether the colonies were killed by gaseous hydrogen cyanide or by that adsorbed by the agar gel. It is suggested that the possibility of useful application of fumigation for the sterilization of rooms soused by rain or firemen's hoses (e.g., bombed museums, damaged stores) being not inconsiderable, the relative merits of other fumigants, in particular formaldehyde, should be investigated without delay.

Padwick (G. W.). **Recent advances in control of fungous diseases of plants.**—*Indian Fmg*, iii, 9, pp. 479–481, 1942.

The writer discusses and illustrates by means of concrete examples some recent advances in the control of plant pathogens. The problem may be approached along various lines, including plant sanitation, comprising all measures for the removal and destruction of infected material; the adjustment of the physical and nutrient conditions of the soil in such a way as to promote the well-being of the crop and arrest the development of the fungus; the breeding of resistant varieties (one of the most popular fields of endeavour of phytopathologists in India, where selection for resistance to a number of important diseases is in progress); and spraying or dusting with an approved fungicide.

Stuart (L. S.) & Harris (T. H.). **Bactericidal and fungicidal properties of a crystalline protein isolated from unbleached Wheat flour.**—*Cereal Chem.*, xix, 2, pp. 288–300, 1 fig., 1 graph, 1942.

At the Bureau of Agricultural Chemistry and Engineering, United States Department of Agriculture, Washington, D.C., A. K. Balls, W. S. Hale, and T. H. Harris separated from the petroleum ether extract of unbleached wheat flour a crystalline, water-soluble, alcohol-insoluble polypeptide containing about 4·5 per cent. sulphur in the form of cystine and being completely precipitated by 2·5 per cent. trichloracetic acid (*Cereal Chem.*, xix, pp. 279–288, 1 fig., 1942). The experiments herein described and tabulated revealed intensive *in vitro* bactericidal activity of the protein, more especially against Gram-positive organisms: in one trial, destruction of the cells of *Staphylococcus aureus* occurred in dilutions as low as 0·005 mg. per ml. The protein likewise exhibited marked fungicidal activity towards the true yeasts, *Saccharomyces cerevisiae*, *Debaryomyces nadiformis* (*Torula histolytica*), and *Endomycopsis*

albicans, the cells of which were also killed at dilutions of 0·005 mg. per ml. and upwards. These results suggest the possible utilization of the protein as a fermentation regulator on the one hand, and on the other, as a mode of therapy in the case of such maladies as tropical sprue and blastomycosis. The mycelial fungi, represented by *Aspergillus niger* and *Rhizopus nigricans,* responded negatively to contact with the protein.

FRIES (N.). **Über das Wuchsstoffbedürfnis einiger Ophiostoma-Arten.** [On the growth substance requirement of some *Ophiostoma* species.]—*Svensk bot. Tidskr.*, xxxvi, 4, pp. 451–466, 1 graph, 1942.

Three species of *Ophiostoma,* viz. *O.* [or *Ceratostomella*] *ulmi* from elm (a Dutch isolation,) *O. coeruleum* [or *C. coerulea*], and *O.* [or *C.*] *stenoceras,* the two latter from ground wood pulp in Sweden [*R.A.M.*, xiv, p. 274], made only rudimentary growth on a synthetic aqueous medium containing glucose, ammonium chloride or tartrate, and inorganic salts, the assimilation of which was facilitated, however, by an admixture of minute quantities of malt or yeast extract. Attempts to replace these extracts by chemical substances gave the following results. The addition of adermin (vitamin B_6) to the substratum at the rate 1 mγ per 25 c.c. induced luxuriant mycelial growth in cultures of *C. ulmi,* while the other two species responded similarly to aneurin or pyrimidin, the effect of which was further strengthened by biotin and, in the case of *O. coeruleum,* by adermin.

CLAYTON (E. E.). **The germination of fungous spores in relation to controlled humidity.**—*Phytopathology,* xxxii, 11, pp. 921–943, 2 figs., 6 graphs, 1942.

The method adopted by the author for the accurate regulation of high relative humidities for spore germination tests [cf. *R.A.M.*, xvii, p. 56 *et passim*] involved the use of clean, dry carriers (surfaces of glass, paraffin, quartz, or leaves), over which the spores were discharged naturally or dusted with a camel-hair brush. The carriers were then suspended in sealed glass chambers (1-qt. fruit jars with glass lids and rubber gaskets) over sucrose or saturated salt solutions or re-distilled water to secure the desired relative humidities, which were computed theoretically, the chambers being placed in a wire container and completely submerged in a water bath with a temperature thermostatically maintained at 20·0$\pm$0·02° C. Mechanical rocking of the container obviated stratification of the atmospheres or the solutions within the chambers. Only to a limited extent at a relative humidity of 100 per cent. was condensation visible on the spore-carriers.

The conidia of *Sclerotinia fructicola* germinated well in re-distilled water, but not over a period of 72 hours on glass, paraffin, or quartz at relative humidities of or below 100 per cent.

The germination of ascospores and conidia of *Venturia inaequalis* from apple leaves on dry glass at a relative humidity of 99 to 100 per cent. was demonstrated for the first time, the mean germination percentages of the ascospores after 24 hours at 100, 99·6, and 99 being 85$\pm$4, 28·2$\pm$5·4, and 0 to 23, respectively; the corresponding figures for wet and dry conidia at the same relative humidities were 74, 67, and 9, and 79, 52, and 14, respectively.

The mean percentage germination of uredospores of *Puccinia coronata, P. graminis tritici* (race 56), and *P. g. avenae* (race 2) was high in water (89, 97, and 99, respectively), but fell progressively at a relative humidity of 100 and 99 per cent. and was practically nil at 98.

It was shown for the first time that chlamydospores of *Ustilago hordei* and *U. nuda* on dry glass or paraffin were capable of germination at relative humidities of 95 to 100 per cent. but not at or below 93. Long basidial hyphae (67 μ after 48 hours) were produced at 100 to 95 per cent. relative humidity, whereas the basidia of spores germinating on water gave rise to sporidia.

Conidia of *Erysiphe polygoni* from red clover, cabbage, and evening primrose (*Oenothera biennis*) on dry glass germinated at relative humidities from 0 to 100 per cent.; at the lower ranges, however, the germ-tubes were very short and survived only for brief periods [ibid., xvi, p. 104].

COOK (H. T.) & HOUGHLAND (G. V. C.). **The severity of Potato scab in relation to the use of neutralized and one-third neutralized fertilizers.**—*Amer. Potato J.*, xix, 10, pp. 201–208, 1 graph, 1942.

Further experimental data are presented in support of the conclusion already reached that the occurrence and severity of potato scab [*Actinomyces scabies*] are influenced by the type of fertilizer only in so far as the latter affects the soil reaction [*R.A.M.*, xviii, p. 475]. In the present series of tests at the Virginia Truck Experiment Station, bringing the total period of the observations under review to seven years, the use of a neutralized kieserite or dolomitic limestone fertilizer resulted in a less acid reaction (P_H 5·2 to 6) and consequently more scab (35·33 per cent.) than a one-third neutralized (P_H 4·7 to 5·1 and 13·34 per cent., respectively).

WAKELY (C. T. N.) & MELLOR (H. C.). **Seed Potato disinfection by conveyor belt dipper.**—*Nature, Lond.*, cl, 3817, p. 769, 1942.

To facilitate the disinfection of large quantities of seed potatoes [against common scab (*Actinomyces scabies*), surface-borne *Phytophthora infestans*, and storage rots], a plant utilizing the conveyor belt principle has been devised. A dipping tank holding approximately 600 gals. fluid is provided with a conveyor belt operating below the surface of the solution. The plant can be worked in conjunction with the usual type of grader, the potatoes being delivered from the picking belt of the grader down a wooden chute into the solution, where they travel horizontally for one minute, after which they pass up out of the tank at an angle of 30°. The elevator delivers them into boxes which are immediately removed to the open field and stacked up for drying, which takes only a few minutes. During the present lifting season, over 1,000 tons seed potatoes were treated by two of the plants, a well-known organo-mercury potato disinfectant being used.

CADMAN (C. H.). **Autotetraploid inheritance in the Potato: some new evidence.**—*J. Genet.*, xliv, 1, pp. 33–52, 1 pl., 1 diag., 1942.

The present study furnishes data in support of the contention that the cultivated potato, with $2n = 48$ chromosomes, regarded by many geneticists as a functional diploid, is in fact an autotetraploid. The experiments are based on the observation that individual potato varieties react to graft inoculation with potato viruses X, A, B, and C by either developing lethal top necrosis or only leaf mosaic of varying degree of intensity. Consequently the presence of top necrosis and its absence are treated as a pair of clear-cut alternative characters. As the potato varieties were found to react essentially similarly to each of the four viruses, reactions to virus X were singled out for detailed consideration. The necrotic reaction to virus X was found to be associated with the dominant allele of a gene designated **nx.** The segregation of this gene in crosses between commercial potato varieties proved to be tetrasomic. Most necrotic-reacting varieties were found to be simplex for the dominant allele; so far only one duplex type was found. The two phases of dominance were indistinguishable phenotypically. It is concluded from these data and from the results of recent genetical work that autotetraploidy offers a sound hypothesis for further investigation.

These conclusions have the following practical significance. It was observed that plants reacting by lethal necrosis to graft infection with virus X in the laboratory were virtually immune from this virus under field conditions. It is suggested that

there should be no difficulty in synthesizing breeding stocks quadruplex for the **Nx** allele and thus producing economically useful varieties field immune from virus X.

SETHI (D. R.). **Cold storage of seed Potatoes.**—*Indian Fmg*, iii, 9, pp. 471–473, 1942.

Losses among stored seed potatoes in the Indian plains due to insect pests and fungal diseases may be very substantial, ranging from 25 to 60 per cent. Directions are given for the complete control of these forms of damage by cold storage at a temperature of 36° F. and a humidity of 75 to 85 per cent. Attention is drawn to certain precautions in the design and construction of the cold store, the method of loading, and the maintenance of proper conditions during the storage period. The potatoes should be left for at least 12 hours in a pre-cooling chamber at 60° to 70° and removed to the chambers for 24 to 72 hours after storage. Potatoes for table use require an entirely different set of conditions for their preservation.

RUSCHMANN (G.) & POZDENA (L.). **Beziehungen zwischen physikalischer und biologischer Bodenerkrankung.** [Relations between physical and biological soil sickness.]—*Zbl. Bakt.*, Abt. 2, cv, 12–13, pp. 213–233, 4 diags., 1 graph, 1942.

A comprehensive, tabulated account is given of the writers' comparative analyses of the physical, chemical, and biological properties of two genetically and morphologically contrasting soil profiles in the vicinity of Landsberg-an-der-Warthe, one situated in the marshes bordering the river and the other (heavy podsol) in a forest on the diluvial plain. The physical and chemical anomalies of both soils were clearly reflected in their biological relationships, as expressed in the extent and composition of their microflora [*R.A.M.*, xxi, p. 502]. In the former, notwithstanding its exceptionally favourable humus content, the total micropopulation was only moderately high, presumably on account of insufficient physiological humidity and an unbalanced distribution of water and air, the adverse effects of which were particularly noticeable in the case of the moulds: at a depth of 0 to 14 cm. (P_H 4·7) the numbers of bacterial spores, Actinomycetes, and moulds per gm. oven dry soil were 1,100,000, 3,400,000, and 39,000, respectively, the corresponding figures at 52 to 75 cm. (P_H 5·6) being 15,600, 14,000, and 1,100, respectively. On the other hand, in the very acid upper layers of the forest podsol, moulds predominated over both the other groups, the numbers of bacterial spores, Actinomycetes, and moulds at a depth of 0 to 8 cm. (P_H 3·3), for instance, being 85,000, 100,000, and 106,000, respectively, whereas in the deeper strata the approach of the hydrogen-ion concentration to neutrality promoted a relatively increased activity on the part of the bacteria and Actinomycetes, the numbers of which at 110 to 150 cm. (P_H 4·8) were 16,000 and over 1,000, respectively, compared with 800 for the moulds. The total micro-populations of the marsh and its profiles (per gm. soil) at 0 to 14 and 52 to 75 cm. were 10,039,000 and 156,000, respectively, the corresponding figures for the forest at 0 to 8 and 110 to 150 cm. being 726,000 and 49,000, respectively, from which the weakness of microbial activity in the latter, attributable in the first place to its advanced podsolization and consequent low P_H values, is apparent.

EVANS (H.). **New light on red rot disease of Sugar Cane.**—*Rep. Mauritius Sug. Cane Res. Sta.*, xii, pp. 25–26, 1941. [Abs. in *Sugar*, xxxviii, 1, pp. 43–44, 1943.]

Physiological investigations, as yet incomplete, of the basis of resistance to red rot (*Colletotrichum falcatum*) in sugar-cane indicate that the reaction of the host to the pathogen is associated with the amount in the former of an amino-phenol of the tyrosin type. It appears that varieties of an extreme degree of resistance or susceptibility to the disease may be immediately recognized by determinations of this chemical substance, whereas in those of intermediate reaction the rôle of the borer [*Proceras sacchariphagus*], which is in turn dependent on the lignin content of the rind, must also be taken into consideration.

Agriculture and animal industry in India, 1938–39.—422 pp., 9 pl. (1 col.), 1 map, Delhi, Imperial Council of Agricultural Research, 1941.

Most of the information regarding plant disease investigations (pp. 143–151) in this review has been noticed from other sources [cf. *R.A.M.*, xix, pp. 258, 583, *et passim*], but the following may be mentioned. Under the Imperial Council of Agricultural Research scheme of investigations into sugar-cane diseases 41 varieties were tested for resistance to red rot (*Colletotrichum falcatum*) and wilt (*Cephalosporium sacchari*). The varieties most susceptible to the former were Co. 362, 531, 526, 223, 417, 419, 421, Co. K. 10, Co. K. 22, and Dehra Dun Ponda [cf. ibid., xxi, p. 347], and to the latter Co. 421, 441, 419, 413, 331, 360, and 528. In Madras, 11 varieties were tested for red-rot resistance, and all except Co. 281 were found to be highly susceptible. Tests of the rate of spread of *C. falcatum* from infected setts to new shoots showed that in the Vellai variety the rate of spread from sett to shoot was very rapid, whereas in P.O.J. 213 no spread had occurred after 3½ months. This result is of interest in view of the fact that P.O.J. 213 almost went out of cultivation in America as a result of the red-rot epidemic of 1930. The strain occurring in Madras is a dark one, and this, presumably, was the strain used in the experiments. The American epidemic was caused by a light strain, which may account for the behaviour of P.O.J. 213.

WEHMEYER (L. E.). **Contributions to a study of the fungous flora of Nova Scotia. VI. Pyrenomycetes.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 572–594, 18 figs., 1942.

In this contribution [*R.A.M.*, xx, p. 135] the author gives an annotated list of 170 species, including seven new to science, and two varieties of fungi belonging to 70 genera of Pyrenomycetes collected in Nova Scotia.

SEAVER (F. J.). **The mycoflora of Bermuda.**—*Science*, N.S., xcvi, 2499, pp. 462–463, 1942.

In the course of this account of his mycological explorations of Bermuda, which were inaugurated (in the company of N. L. Britton) over 30 years ago, the writer briefly describes a few of the more interesting species of fungi collected, in some cases in collaboration with H. H. Whetzel or J. M. Waterston [*R.A.M.*, xxii, p. 113], with special reference to the connexions between the Islands and the continents of Europe and North America in respect of the geographical distribution of these organisms.

HESLER (L. R.). **Notes on Southern Appalachian fungi, IV.**—*J. Tenn. Acad. Sci.*, xvii, 3, pp. 242–249, 4 figs., 1942.

This is a continuation of the author's critically annotated list of rare or otherwise interesting fungi recently collected in eastern Tennessee and western North Carolina [cf. *R.A.M.*, xx, p. 323].

HENRY (L. K.). **A review of the pileate Polypores of western Pennsylvania.**—*Ann. Carneg. Mus.*, xxviii, 13, pp. 221–272, 4 pl., 1941.

This is an annotated list of 96 Polyporaceae collected in western Pennsylvania, of which 28 are rare in the area under observation and two recorded for the first time in the State.

LINDQUIST (J. C.). **Micromicetos nuevos para la flora argentina.** [New micromycetes for the Argentine flora.]—*Darwiniana, B. Aires*, v, pp. 241–247, 1941.

The present contribution to the available information on the mycoflora of the Argentine forms a continuation of Parodi and Hauman's list of fungal parasites of cultivated plants (*Rev. Fac. Agron., B. Aires*, iii, pp. 227–274, 1921), and comprises technical diagnoses of, and critical notes on, 21 fungi, including *Pseudoplea briosiana* [*P. trifolii*] (syn. *Pleosphaerulina briosiana*) on lucerne, *Ascochyta atropae* on *Atropa belladonna*, *A. bohemica* on *Campanula media*, *A. cannae* on *Canna indica*, *A. gossypii*

on cotton, *A. lathyri* on sweet pea, *Septoria digitalis* on *Digitalis purpurea*, *S. gladioli* on gladiolus, *S. henriquesii* f. *santonensis* on *Matthiola incana*, *S. macrospora* on *Chrysanthemum leucanthemum*, *S. rosae* on rose, *Colletotrichum violae-tricoloris* on sweet violet, *Cercospora apii* var. *carotae* on carrot, and *C. resedae* on *Reseda odorata*.

Milthorpe (F. L.). **Studies on Corticium rolfsii (Sacc.) Curzi (Sclerotium rolfsii Sacc.). I. Cultural characters and perfect stage. II. Mechanism of parasitism.**—*Proc. Linn. Soc. N.S.W.*, lxvi, 1–2, pp. 65–75, 1 pl., 7 figs., 1941.

Studies on eight isolates of *Corticium rolfsii* [*R.A.M.*, xi, p. 748; xxi, p. 130], the agent of severe damage to a number of crops in New South Wales, are fully described and tabulated.

The abundance and type of vegetative growth were found to be largely determined by the nature of the medium and the temperature at which the cultures were maintained, the same factors likewise influencing the quantity and size of the sclerotia, but not their shape or colour. Thus, on carrot agar, growth is white, dense, and feathery, on potato dextrose agar the mycelium is more luxuriant than on onion or onion-proteose-peptone agars, peptone dextrose broth gives rise to a very feathery, thick, densely flocculent, and rapidly spreading mycelium, in contrast to the sparse development on pectin broth. Sclerotial production was more profuse on carrot and potato dextrose than on the onion agars. Two of the isolates produced large, somewhat irregular, and relatively few sclerotia, while in the others these organs were small, globose, uniform, and numerous.

Growth on potato dextrose agar (the medium used for the temperature studies) proceeded very slowly at 15° C., increased rapidly with a rise to 25°, and reached an optimum at 30°, above which there was a speedy decrease to a minimum at 37°. Sclerotial production reached a maximum at 25° to 30°, falling off at 37° and 20°, especially at the lower temperature.

Three of the isolates formed fructifications on onion-proteose-peptone and potato dextrose agars, the former substratum being preferable for this purpose. This is the first record of the perfect stage of the fungus for Australia. The basidia arising from the dense, white, crustiform hymenia are hyaline, clavate, 2·01 to 5·61 by 1·67 to 3·61 (mean 4·16 by 2·47) μ, and produce at their apices four tapering sterigmata, 1·34 to 2·57 (1·95) μ in length; the hyaline, piriform to globose basidiospores measure 1·64 to 2·51 by 1 to 1·72 (1·94 by 1·37) μ. The slight divergence between the Australian isolates and Curzi's description of *C. rolfsii* are not considered to warrant specific differentiation, though certain affinities with *C. centrifugum* [ibid., xiii, p. 273] in respect of vegetative growth are recognized. Distinct variations in the growth habits of seven monobasidiosporidial cultures were observed, the increase in mean diameter of the colonies, for instance, ranging from 10 to 32 mm. in 24 hours; only three of the cultures produced hymenia, and evidence of heterosexuality could not be demonstrated. It is concluded either that sporulation can only be induced by certain specific conditions, or that the capacity for fructification is readily lost, the former theory being the more plausible.

The mechanism of parasitism by *C. rolfsii* was studied in germinating bean [*Phaseolus vulgaris*] seeds inoculated through the hypocotyls with a mycelial suspension of the pathogen and incubated at 30°. On reaching the cuticle the small mycelial strands form appressoria and penetration hyphae, which enter the epidermal cells, causing plasmolysis and death. Within the invaded tissues, many more large, oval appressoria are formed. The hyphae, coenocytic at first, gradually acquire cell walls. They are usually multinucleate at all stages of invasion, growing parallel to the long axis of the cell, more rarely obliquely, and seldom across. Death of the cytoplasm precedes hyphal invasion to a depth of one layer. When the cells are fully permeated by the hyphae, the nuclei disintegrate and disappear. Dissolution of the middle lamella was apparent at an early stage in the activity of the pathogen, the rapid

maceration of the tissues denoting the presence of a pectilytic enzyme. Investigations on the nature of the toxic principle by the methods of Davison and Willaman [ibid., vii, p. 192] revealed the production of both protopectinase and pectinase, to the activity of which the pathological effects on the plant tissues are attributed.

SALVIN (S. B.). **Preliminary report on the intergeneric mating of Thraustotheca clavata and Achyla flagellata.**—*Amer. J. Bot.*, xxix, 8, pp. 674–676, 2 figs., 1942.

After stating that many species of the Saprolegniaceae combine asexual characters of two or more genera of this family, and citing a number of examples, the author expresses the view that the mixed characteristics of these species may indicate primitiveness or may be the result of intergeneric matings. Experiments were therefore conducted to determine whether such matings can be induced between two homothallic species with diclinous antheridia. Fifty-one combinations of species were tried, but only that between *Thraustotheca clavata* and *Achyla flagellata* resulted in interspecific matings. Under the experimental conditions, as the oogonia of *A. flagellata* developed beside the hyphae of *T. clavata*, antheridia of the latter were formed and became attracted to the adjacent oogonia. The antheridia later became attached, formed fertilization tubes, and appeared to induce fertilization, oospores being observed soon after.

These results are the first to indicate that sexual fusion may take place between the homothallic thalli not only of two separate species, but also of two separate genera. Until, however, the oospores are germinated, and the characteristics of the resulting generations have been studied, the work does not conclusively prove that sexual or nuclear fusion took place between the two species.

It is concluded that considerable significance attaches to these intergeneric matings of two homothallic species. They indicate that sexual fusion in nature may well occur between homothallic species of the same or different genera of the Saprolegniales. A further inference is that species with intermediate asexual characters may have originated from interspecific hybridization, while the sudden appearance of an atypical method of asexual reproduction in a given species may be similarly explained. There is also an indication that the modern concept of a genus in the Saprolegniaceae may be inadequate, since it fails to consider the possible mingling of characters that may result from intergeneric matings.

BRODIE (H. J.). **Protoplasmic continuity in the powdery mildew Erysiphe graminis DC.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 595–601, 1 pl., 1 fig., 1942.

The study of living mycelial and conidial cells of the barley powdery mildew, *Erysiphe graminis*, at the University of Manitoba, Canada, with the help of a slight modification of Wahrlich's staining technique [*R.A.M.*, xii, p. 776], revealed that the protoplasm is continuous from cell to cell, the delicate strand of cytoplasm, 1 to 1·5 μ wide, passing through minute central pores in the transverse septa. These findings were recorded by means of photomicrographs and drawings. The author failed to detect streaming of cytoplasm by direct observation, this being possibly due to the slow rate of flow or to the difficulty of examining the mycelium without disturbing it.

BEDFORD (C. L.). **A taxonomic study of the genus Hansenula.**—*Mycologia*, xxxix, 6, pp. 628–649, 1942.

Of the 100 cultures of yeasts obtained from various sources in the United States, Europe, Asia, and South Africa as species of *Hansenula*, 79 were left by the author in this genus, while six were placed in *Pichia*, eight in *Candida*, two each in *Torulopsis* and *Zygohansenula*, and one in *Brettanomyces*.

ROELOFSEN (P. A.). **Recent research at the Deli Tobacco Experiment Station, Medan, Sumatra.**—*Emp. J. exp. Agric.*, xi, 41, pp. 15–22, 1943.

An account is given of some of the recent activities of the agricultural, botanical,

entomological, and agrochemical departments of the Deli Tobacco Experiment Station, Medan, Sumatra, reference to the phytopathological aspects of which has already been made from time to time in this *Review*.

SMITH (T. E.). **Investigations of control measures for Granville wilt of Tobacco.**—Abs. in *J. Elisha Mitchell sci. Soc.*, lviii, 2, p. 133, 1942.

Experiments have been in progress in North Carolina since 1935 to develop more effective measures for the control of Granville wilt (*Bacterium solanacearum*) of tobacco [*R.A.M.*, xvii, p. 787]. A considerable reduction in the incidence of the disease was effected by triennial rotations with maize, soy-beans, or red top grass [*Agrostis palustris*], but the complete elimination of the pathogen by this means appears unlikely. Soil treatment with chloropicrin is efficacious but too expensive for large-scale use. Promising results were given by a combination of a maize rotation with the application to the soil of urea (uramon) at the rate of 1,000 lb. per acre. A high degree of genetic resistance to the wilt was found in a collection of tobacco from Colombia, and progress has been made by hybridization and selection towards the development of resistant varieties of flue-cured tobacco.

LOOS (C. A.). **Some virus diseases of Stachytarpheta.**—*Trop. Agric.*, xcviii, 1, pp. 8–12, 2 pl., 1942.

Stachytarpheta jamaicensis, a common weed of the low and mid-country of Ceylon, is subject to three virus diseases, namely, mosaic (yellow blotch), rosette, and yellow veinbanding, of which the two first-named are thought to be new records for the host in question, while the symptoms of the last-named are similar to those already described for *Ageratum conyzoides* [*R.A.M.*, xx, p. 605]. The mosaic and rosette symptoms were transmitted from diseased to healthy plants by grafting. Of no intrinsic importance, *S. jamaicensis* may well assume considerable significance as the host of a virus, probably of the tobacco leaf-curl group.

COHEN (S. S.). **New crystalline forms of Tomato bushy stunt virus.**—*Proc. Soc. exp. Biol., N.Y.*, li, 1, pp. 104–105, 2 figs., 1942.

By the use of the author's new technique (*J. biol. Chem.*, cxliv, 2, pp. 353–362, 1942), employing hydrophilic colloidal materials, such as heparin and starch, new crystalline forms of tomato bushy stunt [*R.A.M.*, xxi, p. 425] and tobacco necrosis (unpublished data of the author and W. M. Stanley) have been obtained. In the case of tomato bushy stunt two previously undescribed crystalline forms of the virus were observed, one consisting of non-birefringent, octahedral prisms, up to 0·2 mm. in length, the ends of which are tapered by joint triangular planes, and the other of rhombohedral, also non-birefringent crystals. The sedimentation constant of the dissolved crystals was that normal for tomato bushy stunt and no significant change in virus activity was apparent from inoculation tests on *Nicotiana glutinosa* and cowpea.

STANLEY (W. M.) & ANDERSON (T. F.). **Electron micrographs of protein molecules.**—*J. biol. Chem.*, cxlvi, 1, pp. 25–30, 2 pl., 1942.

As a preliminary to the examination by the electron microscope [*R.A.M.*, xx, p. 428 *et passim*] of five proteins of varying molecular size, including tomato bushy stunt, a similar study was made of a dilute solution of silver nitrate (supplying the high density essential to satisfactory contrast relations) containing 0·01 mg. ultracentrifugally purified tobacco mosaic virus per c.c. The highly magnified reproduction of an electron micrograph of this preparation shows rods of the virus 150 Å wide and of low contrast scattered over the field, together with numerous small particles, presumably of silver, formed during the preparation and evaporation of the collodion membrane mount.

The 113 particles of a similarly purified and mounted tomato bushy virus prepara-

tion revealed on the micrograph measured on an average 26 mμ in diameter, thereby confirming the results of previous determinations by indirect methods [ibid., xx, p. 38 *et passim*].

WILSON (J. D.) & MOORE (W. D.). **Comparison of sprayed Tomato plants grown as seedlings in Georgia and Ohio.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxvii, 214, pp. 17–25, 1942.

This is a tabulated survey of the results of comparative experiments conducted from 1938 to 1940 to determine the effects of Bordeaux mixture and certain fixed copper compounds on various tomato diseases, two lots of plants being used in each year, one raised in Ohio and the other (from the same seed stocks) in Georgia, which supplies more than half the acreage of the canning crop grown in the northern State [*R.A.M.*, xxi, pp. 230, 432]. The Marglobe variety was tested in 1938 and 1940 and Greater Baltimore in 1939. Bordeaux mixture, though very effective against foliar diseases, including early blight (*Alternaria solani*) and leaf spot (*Septoria lycopersici*), caused heavy reductions in yield, so much so, in fact, that the treated plants sometimes produced less than the controls: coposil proved similarly injurious in 1938. In 1939 blossom-end rot was more severe on treated than on untreated plants, a possible indication that fungicidal applications tend to enhance the adverse effects of a deficiency of atmospheric and soil moisture [ibid., xvi, p. 420]. In two trials in which anthracnose fruit rot (*Colletotrichum phomoides*) was troublesome, the treated plots yielded much more heavily than the controls. Bordeaux mixture should not be applied to the southern-grown plants for several days before pulling for shipment to Ohio. The spraying, ten days after arrival in Ohio, of plants inoculated with *A. solani* before dispatch from Georgia arrested the progress of the foliar phase of the disease but did not eliminate the stem cankers.

CUNNINGHAM (G. H.). **Disease-free seed for Tomato growers.**—*Orchard. N.Z.*, xiv, 9, pp. 23–24, 1941.

The three major tomato diseases in New Zealand, viz., tobacco mosaic, bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*), and leaf mould (*Cladosporium fulvum*), are stated to be responsible for annual losses totalling upwards of 50 per cent., representing an actual cash loss of some £70,000. With a view to reducing the amount of damage from the last-named, four resistant or immune varieties have been imported from overseas and grown on a large scale under glass in the Owairaka area, namely, Kondine Red, Bay State, Globelle, and Vetomold [*R.A.M.*, xxii, p. 81], of which the last named proved to be the most satisfactory. A survey of its reactions to the physiologic strains of the pathogen present in the Dominions revealed its immunity. It is similar to Kondine Red in appearance and even more prolific. In Bay State the character for resistance is not yet fixed, about 5 per cent. of the plants having contracted leaf mould. Globelle was immune from *C. fulvum*, but yielded poorly and the fruits showed a tendency to crack. Efforts are being made to overcome these defects by means of appropriate crossing. Leaf mould developed early in Kondine Red, but was held in check by spraying with shirlan AG (3 lb. in 100 gals. water).

HARACSI (L.). **A Cseresek veszedelme : a kétalakú tupló (Fomes obliquus (Pers.) Fries).** [The dimorphous (oblique) wood rot (*Fomes obliquus* (Pers.) Fries): an enemy of *Quercus cerris*.]—*Erdész. kisérl.*, xliii, 1–2, pp. 1–31, 10 figs., 1941. [German summary. Abs. in *Biol. Abstr.* xvi, 10, p. 2337, 1942.]

At the Forestry Research Institute, Sopron, Hungary, the writer ascertained that the dark brown knobs on the bark of *Quercus cerris*, birch, and other trees are not sterile or abnormal fruiting bodies of *Fomes nigricans* but the conidial cushions of *F. obliquus* [*Poria obliqua*: *R.A.M.*, xix, p. 56], which produces two forms of sporophores, one tuberous and the other tubular. The (conidio-)chlamydospores of the

knobs are asexual reproductive organs, the sexual phase being represented by the basidiospores arising from the tubular fruiting bodies. Chlamydospores may also be produced by the brown mycelium covering the surface of decayed wood. *P. laevigata*, which occurs on birch, is probably identical with *P. obliqua*. The fungus constitutes a serious menace to *Q. cerris* stands by reason of its wide distribution and intense wood-destroying activity.

Johnson (L. P. V.) & Linton (G. M.). **Experiments on chemical control of damping-off in Pinus resinosa Ait.**—*Canad. J. Res.*, Sect. C, xx, 12, pp. 559–571, 1942.

In greenhouse and nursery experiments conducted from 1939 to 1942 at Ottawa and Orono, Canada, the best control of the damping-off disease of red pine (*Pinus resinosa*) seedlings [*R.A.M.*, xviii, p. 561] resulted from applications to the soil of semesan solution in concentrations of 1 : 100 to 1 : 150 at the time of sowing and at emergence in the greenhouse, or at bi-weekly periods from the time of sowing until four to five weeks after emergence in the nursery. In the greenhouse this treatment was equally or slightly more effective than steam sterilization of the soil. The next best results, particularly in the greenhouse, were obtained with red copper oxide suspension in concentrations of 1 : 250 to 1 : 500 applied to the soil following the same time-table as given above for semesan. Seed treatment with red copper oxide and zinc oxide dusts gave effective control in the greenhouse. Under greenhouse conditions combined seed and soil treatments were no more effective than either of them applied separately, while under certain nursery conditions the combined treatments were significantly less effective. Dusts proved generally greatly superior to liquid materials for seed disinfection, and fungicides as a group more constantly effective than acidifying agents such as sulphuric acid and aluminium sulphate. The fact that acidification gave little or no control in seasons of excessive rainfall or drought is presumed to be related to the reduction of acidity to a non-effective level through removal by percolation in the one case and the action of the slightly alkaline irrigation water in the other. It is assumed that whereas fungicides kill the damping-off organisms, acidification only prevents their development by conditioning an unfavourable environment. Seedlings from two-year-old pine seed of somewhat reduced vitality were found to be far more susceptible to damping-off than those from one-year-old seed. White spruce (*Picea glauca*) used in some of the preliminary tests proved to be much less susceptible to damping-off than red pine, although very similar in response to the various treatments.

Pomerleau (R.). **Études sur la fonte des semis de conifères.** [Studies on the damping-off of conifer seedlings.]—*Rev. trim. canad.*, xxviii, 110, pp. 127–153, 1 fig., 3 graphs, 1942.

Some of the conclusions drawn from the author's intensive six-year studies on damping-off of red pine [*Pinus resinosa*] and white spruce [*Picea glauca*] in Quebec have already been summarized from another source [*R.A.M.*, xxi, p. 508], but the following points may be of interest. Apart from the heavy losses, amounting to nearly 100 per cent., caused by the pathogens (*Pythium de Baryanum*, *Rhizoctonia* [*Corticium*] *solani*, and *Fusarium* spp.) at the warm soil temperatures (of 60° F. and upwards) conducive to their growth, a reduction of nearly 20 per cent. in the stand is to be expected even in seasons favourable to the hosts. Late spring sowings are more liable to infection than those made in the autumn, which germinate before the rise in soil temperature and thus escape injury.

Smith (C. O.). **Crown gall on species of Taxaceae, Taxodiaceae, and Pinaceae, as determined by artificial inoculations.**—*Phytopathology*, xxxii, 11, pp. 1005–1009, 3 figs., 1942.

Continuing his inoculation experiments with pure cultures of *Phytomonas* [*Bacter-

ium] *tumefaciens* on conifers at Riverside, California [*R.A.M.*, xix, p. 389], the writer secured gall development on nursery trees of *Podocarpus elongata*, *Taxus baccata* var. *erecta*, *T. brevifolia*, *T. media*, and *Torreya californica* (Taxaceae); *Cunninghamia lanceolata*, *Sequoia gigantea*, *S. sempervirens*, and *Sciadopitys verticillata* (Taxodiaceae); and *Abies cephalonica*, *A. concolor*, *A. firma*, and *A. holophylla* (Pinaceae).

KAUFERT (F. H.) & BEHR (E. A.). **Susceptibility of wood to decay. Effect of urea and other nitrogen compounds.**—*Industr. Engng Chem.*, xxxiv, 12, pp. 1510–1515, 1942.

Urea or carbamide is being increasingly used in the United States as a chemical seasoning agent for timber, while other nitrogenous compounds, notably ammonium sulphate and ammonium phosphate, are largely employed for fire-retardant or flame-proofing purposes. Concern having been expressed as to the possible stimulation of fungal decay by these substances, experiments were carried out at the University of Minnesota to determine their effects on the rate of rotting of loblolly pine (*Pinus caribaea*) sapwood and the heartwoods of cypress, red oak (*Quercus borealis* var. *maxima*), and Douglas fir [*Pseudotsuga taxifolia*] by malt agar cultures of *Lenzites trabea*, *Lentinus lepideus*, *Poria incrassata*, and *Trametes serialis*, the oak samples being additionally inoculated with *Daedalea quercina* and those of Douglas fir with an unidentified wood-rotting fungus designated RS. In small amounts the compounds either failed to accelerate the normal course of decay, or their influence in this direction was so slight as to be negligible from a practical standpoint, whereas at higher concentrations of 1 per cent. and upwards (1 to 1·5 per cent. urea corresponds to the recommended minimum of 40 lb. per 1,000 board ft.), they caused marked reductions in the incidence of infection, judged by the percentage loss of weight after three months' exposure to the pathogens, urea and ammonium sulphate being particularly active in this respect. Low concentrations of asparagin and peptone increased the velocity of decay in the pine and oak samples, but exerted little or no effect on Douglas fir: cypress contracted no measurable degree of infection throughout the period of the trials.

The addition of peptone agar suspensions of soil bacteria to the urea-treated Douglas fir samples did not substantially enhance their susceptibility to fungal decay, but more extensive tests are necessary before final conclusions can be drawn regarding this aspect of the investigations.

Heating urea-treated Douglas fir wood to 70° to 100° C. for 12 to 14 hours induces considerable decomposition and loss of urea, but a certain amount of the compound becomes fixed and is only removed with difficulty by leaching. Otherwise the nitrogenous substances readily disappear under conditions favouring leaching, and a standard preservative treatment should probably be applied to wood thus treated where risk of decay is anticipated.

WENZL (H.). **Ist die Bespritzung der Blattunterseiten bei Bekämpfung der Cercospora-Blattfleckenkrankheit der Rübe notwendig?** [Is it necessary to spray the under surface of the leaf in controlling *Cercospora* disease of Beet?]—*Z. PflKrankh.*, li, pp. 20–24, 1941. [Abs. in *Ital. agric.*, lxxix, 6, pp. 330–331, 1942.]

In experiments carried out during 1939 in three different localities between the upper and lower reaches of the Danube beet leaves were sprayed (1) on both surfaces, (2) on the under surface only, and (3) on the upper surface only with a copper oxychloride preparation containing 15 per cent. copper at a concentration of 1·5 per cent., applications being made at the rate of 700 l. per ha. at intervals of three weeks from the end of June until 20th August [*R.A.M.*, xviii, p. 721].

Infection by *Cercospora* [*beticola*] appeared after the second spray treatment. In October, it was found that the unsprayed control plots were severely affected, whereas the treated plots showed only very light infection. Applications of spray only to the

under surface of the leaf were clearly less effective than applications to the upper side alone, or to both surfaces. In general, spraying the upper surface alone was at least as effective as spraying both sides.

KENDRICK (J. B.) & SNYDER (W. C.). **Fusarium wilt of Radish.**—*Phytopathology*, xxxii, 11, pp. 1031–1033, 1942.

Fusarium oxysporum f. *raphani* n.f. is the name applied to the pathogen responsible for the vascular wilt of White Chinese Winter radishes (*Raphanus sativus* var. *longipinnatus*) in California, reference to which has already been made [*R.A.M.*, xv, p. 548]. Of the eight radish varieties used in inoculation experiments, only Chinese Rose Winter and French Breakfast gave any evidence of resistance with 25·5 and 35·3 per cent. infection, respectively, compared with 90·3, 87·8, 85·8, 79·6, 75·8, and 71 for California Mammoth White, White Chinese Winter, White Icicle, Scarlet Turnip, Long Scarlet, and Long Black Spanish, respectively. Early Jersey Wakefield cabbage and Jersey kale showed no infection.

SHARVELLE (E. G.), YOUNG (H. C.), & SHEMA (B. F.). **The value of spergon as a seed protectant for canning Peas.**—*Phytopathology*, xxxii, 11, pp. 944–952, 4 graphs, 1942.

In 1940 and 1941, when root rots of peas (*Rhizoctonia* sp., *Fusarium martii* var. *pisi*, and *Aphanomyces euteiches* in the former year, and a species of *Pythium* in the latter) assumed epidemic proportions in southern Minnesota, experiments were carried out to determine the relative value of different seed treatments in the control of these pathogens. In 1940 spergon [*R.A.M.*, xxi, pp. 511, 515], applied at the rate of 2 oz. per bush., produced an average increase in stand of 23 per cent., comparable results being obtained with new improved ceresan, used in one test, while nitrogen inoculation with a bacterial gel gave a surplus over the control plots of 10 per cent. The average increase in the yield of green, shelled peas due to the spergon treatment in 1940 was 357 lb. per acre or 18 per cent. over the untreated lots of seed. The average reduction in root-rot infection in the spergon-treated plots amounted to 44 per cent., the corresponding figure for new improved ceresan being 47. The outcome of the 1941 trials with spergon showed an increase in yield of 13·9 per cent. over the untreated, but no increase in yield was obtained from this treatment in combination with nitrogen inoculation. Spergon appears to exert a definite stimulus on root growth.

KLIGMAN (A. M.). **Control of fungi in Mushroom casing soil by sterilization.**—*Phytopathology*, xxxii, 11 pp. 978–985, 1 fig., 1942.

At the Pennsylvania State College the spores of *Mycogone perniciosa*, *Verticillium malthousei* [*R.A.M.*, xiii, p. 286; xix, p. 516], and *Dactylium dendroides* in mushroom [*Psalliota* spp.] casing soil were destroyed by chloropicrin at the rate of 2 ml. per cu. ft., and the same compound at a concentration of 3 ml. per cu. ft. gave satisfactory results in roughly constructed wooden bins, 11½ by 9 by 3 ft., erected on the composting ground at the back of the mushroom houses. In two field plots, 6 ft. square, 3 ml. of the chemical were injected to a depth of 3 in. into the centre of each 1-ft. square, one plot being covered with canvas and the other left uncovered; the soil from the former yielded disease-free mushrooms, the latter 35 per cent. infected, and the untreated soil infected mushrooms on emergence. The treated plots were sprinkled with water before covering with canvas, the edges of which were buried in the soil, to prevent the escape of the gas. The crops grown on the chloropicrin-treated soil were comparable with those obtained from plots sterilized with formalin and steam. The use of chloropicrin for the fumigation of empty houses was found to be uneconomical.

DAINES (R. H.). **Sweet Potato pox.**—*Circ. N.J. agric. Exp. Sta.*, 437, 8 pp., 1942. [Abs. in *Hort. Abstr.*, xii, 4, p. 214, 1942.]

Actinomyces ipomoea, the agent of sweet potato pox [*R.A.M.*, xx, p. 320], thrives

only in alkaline soils, directions for the acidification of which by means of sulphur are given. In soils known to be infested by the pathogen efforts should be made to maintain the hydrogen-ion concentration at P_H 4·4 to 5 for sweet potato cultivation, without appreciable deviations in either direction.

FERNANDO (M.) & UDURAWANA (S. B.). **The nature of the mosaic disease of Bandakka (Hibiscus esculentus L.).**—*Trop. Agriculturalist*, xcviii, 1, pp. 16–24, 2 pl., 1942.

The most prominent symptom of the prevalent mosaic of *Hibiscus esculentus* [cf. *R.A.M.*, xx, p. 242] in the Matale district of Ceylon, where the host is grown as part of a mixed crop with cowpeas and cucumbers, is a yellow veinbanding of the leaves, sometimes accompanied by interveinal buckling and minute enations on the abaxial side of the net veins. Occasionally the entire leaf surface may assume a chlorotic tinge. The fruits of diseased plants are dwarfed and malformed, often presenting excrescences at their distal ends, and with a tendency to chlorosis where the normal coloration is dark green.

The volume of evidence provided by statistical analyses of records of disease incidence indicates that the mosaic is infectious, and its transmission by the patch-budding of scion material from chlorotic to healthy plants definitely points to a virus as the pathogenic agent. Under field conditions an insect is presumably responsible for the spread of the mosaic, which was experimentally shown not to be seed-borne. The most practicable method of control would appear to lie in the roguing of affected plants and such potential hosts of the virus as *Ageratum conyzoides*, *Vernonia cinerea*, and *Emilia javanica*.

Wissenschaftlicher Jahresbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, 1940. [Scientific Annual Report of the National Biological Institute for Agriculture and Forestry, 1940.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 65, 1941. [Abs. in *Z. PflKrankh.*, lii, 11, pp. 513–516, 1942.]

Further items of phytopathological interest are cited from the above-mentioned report [cf. *R.A.M.*, xxii, p. 90]. H. Richter (pp. 12–13) found that the refuse of diseased plants left over from the harvest and contaminated stable manure are the principal sources of perpetuation of lupin wilt (a form of *Fusarium oxysporum*) [ibid., xviii, p. 832]. *Verticillium albo-atrum*, hitherto restricted to the perennial lupin in Holland, was observed in Germany on *Lupinus polyphyllus*, *L. albus*, and *L. mutabilis*. *L. albus* was further attacked by *Botrytis cinerea* and *F. avenaceum*, the latter causing a hitherto undescribed pod rot.

Pythium de Baryanum was shown by H. Schultz (pp. 13–14) to be of great importance as an agent of foot rot in blue [*L. angustifolius*] and white lupins [ibid., xix, p. 282], other species of minor significance isolated from which include *P. intermedium*, *P. polymorphon*, *P. irregulare*, *P. mamillatum*, and *P. artotrogus*. Six out of 11 strains of *Rhizoctonia* [*Corticium*] *solani* isolated from foot-rotted plants proved to be pathogenic to lupins [ibid., xviii, p. 832]. *Sclerotinia sclerotiorum*, present on foot-rotted lupins in the field, caused infection only of the above-ground portions in inoculation tests. Emergence of the blue lupin may be reduced by an abundance of *Botrytis* [? *cinerea*] inoculum. *Thielavia* [*Thielaviopsis*] *basicola* [ibid., xvi, p. 539] is particularly injurious to the white lupin.

H. Pape's observations on *Alternaria brassicae* on rape (pp. 80–81) showed that spore dissemination is effected chiefly by the wind; seed transmission, though not impossible, is devoid of practical importance.

[O.] Schlumberger's tests (p. 18) on the reaction to wart disease [*Synchytrium endobioticum*] of 67 potato varieties under observation by the Reich Food Board [ibid., xix, p. 564] showed that 17 were either immune or resistant in varying degrees.

K. O. Müller's studies (pp. 25–26) on the development of resistance to *Phytophthora infestans* in potatoes [ibid., xxi, p. 501], extending over a period of 15 years, have been brought to a conclusion for the time being. Several of the medium-early, medium-late, and late varieties tested in 1940 proved to be resistant to physiologic race A of the fungus and in other respects also well worthy of cultivation. The problem of breeding varieties resistant to the other races, however, remains to be solved. *P. infestans* appears to be seldom, if ever, transmitted by seed potatoes.

R. Griesinger found (pp. 27–28) that the residual (non-albuminous) nitrogen content of *Phytophthora*-diseased potato tubers is appreciably diminished in relation to that of albuminous and more especially of protein nitrogen. No relationship was found between the non-albuminous nitrogen content and resistance.

L. Rohrer ascertained (p. 86) that under the climatic conditions of the Ostmark copper oxychloride preparations must be used at concentrations at least twice as strong as Bordeaux mixture to produce comparable results against vine downy mildew (*Plasmopara viticola*). In experiments by H. Zillig and L. Niemeyer 0·5 per cent. Bordeaux mixture conferred adequate protection against mild cases of the disease in dry weather.

The results of field trials carried out by Langenbuch and Heiling (pp. 63–64) showed that the resistance of raspberries to cane blight (*Didymella applanata* and *Coniothyrium* [*fuckelii*]) is enhanced by the application to the soil of humus, potassium, and phosphoric acid, and decreased by heavy nitrogenous manuring.

Inoculation experiments by H. W. Wollenweber and K. Röder (p. 48) with *Graphium* [*Ceratostomella*] *ulmi* on a dozen elms of the Christine Buisman variety failed to induce a trace of infection [ibid., xvii, p. 636]. Within the old focus of infection at Feldkirch, Vorarlberg (Ostmark), *Phaeocryptopus gaeumanni* was detected on the green [*viridis*] form of Douglas fir (*Pseudotsuga taxifolia*) [ibid., xvii, p. 714].

VOELKEL (H.). **Die wichtigsten Krankheiten und Schädlinge der landwirtschaftlichen Kulturpflanzen im Jahre 1941.** [The most important diseases and pests of agricultural cultivated plants in the year 1941.]—*Beil. NachrBl. dtsch. PflSchutzDienst*, xxii, 2, 20 pp., 1942. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 12–13, p. 238, 1942.]

This report, compiled on the usual lines, on the incidence of plant pests and diseases in Germany during 1941 [cf. *R.A.M.*, xviii, p. 436], is preceded by brief preliminary observations on injuries of meteorological origin and accompanied by 46 maps serving to illustrate the text and facilitate a rapid survey of the extent of the various disorders.

Department of Botany.—*Rep. Ont. agric. Coll., 1941*, pp. 44–48, 1942.

The following items of phytopathological interest occur in this report. Of 12 barley varieties inoculated with loose smut [*Ustilago nuda*] in 1940, the seed-grain being sown in the following year, Trebi was the only one to exhibit complete immunity, the incidence of infection among the remainder ranging from 1 per cent. in O.A.C. No. 21 to 18 per cent. in White Hulless. A definite correlation appears to exist between the degree of susceptibility to *U. nuda* and looseness of hull on the ripe grain. Renown, Regent, and Reward were the most susceptible of seven spring wheats tested for their reaction to loose smut [*U. tritici*], the last-named showing 18 per cent. smutted heads, while of the four winter varieties, Dawtas and Junior No. 6 proved to be resistant, while Dawson's Golden Chaff and Dawbul were very susceptible.

The first case of 'X' disease of peaches and chokecherries [*Prunus virginiana*: *R.A.M.*, xxii, p. 10] in the Niagara Peninsula was diagnosed on 25th July, 1941, but there is reason to believe that it had already been present in some orchards (mostly

in the Bartonville district in the western section of the region under inspection) for as long as four years.

Two applications of cuprocide gave very satisfactory control of tomato leaf spot [*Septoria lycopersici*] in three comparative experiments in different parts of Ontario.

Brown heart of Laurentian turnips was effectively combated by spraying with a saturated aqueous solution of borax with the addition of 0·25 per cent. orvus.

Extensive destruction of greenhouse stocks [*Matthiola incana*] was caused by root rot and stem blight (*Rhizoctonia*) [*Corticium solani*: ibid., xx, pp. 168, 582], infection by which may be prevented by soil sterilization with steam or formalin, or renewal by the removal of the old soil to a depth of 10 in. and its replacement with fresh material not previously used for ornamentals. Another wise precaution consists in 30 minutes' immersion of the seed in a 0·1 per cent. mercuric chloride solution, followed by washing in water.

VEITCH (R.). **Report of the Director of Plant Industry (Research).**—*Rep. Dep. Agric. Qd 1941–1942*, pp. 5–8, 1942.

In this report [cf. *R.A.M.*, xxi, p. 183] the author states that the five-year programme of work in Queensland on tomato diseases and their control by spraying and dusting was completed late in 1941. The insoluble copper compounds tested were as effective as Bordeaux mixture, and had the advantage of not reducing yield. As regards dusts, both basic copper carbonate with kaolin and dehydrated copper sulphate with hydrated lime gave effective disease control. When disease is present in epidemic proportions, spraying may be more effective than dusting, which also entails more numerous applications than spraying; but when only average infection prevails, dusting is as effective as spraying, besides being easier to carry out.

A survey of maize diseases on the Atherton Tableland showed the most important to be the ear rots, which were most commonly caused by *Diplodia* spp., *Gibberella zeae*, *Fusarium* spp., and *Basisporium* [*Nigrospora*] sp. Smut (*Sorosporium reilianum*) [cf. ibid., xvii, p. 519] caused loss on a few farms.

Lucerne in parts of the Atherton Tableland is affected by a stem anthracnose caused by a species of *Vermicularia* [*Colletotrichum*: ibid., viii, p. 268; xi, p. 545]. Incidence appears to be closely related to rainfall and soil acidity.

The occurrence of mouldy balls in silage was investigated. It was ascertained that, where the rate of consumption is slow, air percolates to a depth of 6 in. into the silage, and favours the growth of aerobic fungi. If the silage is used up at the rate of 6 in. daily, the trouble should cease.

A disease which rapidly killed Bathurst burr [*Xanthium*] in several localities in 1942 may, it is thought, prove to be of value in the control of this weed. However, because of late rains, the plants were young and were growing rapidly during the cool, wet weather experienced towards the end of the summer, so that some of the conditions that may have influenced the disease were not altogether typical. A species of *Colletotrichum* was isolated from the infected plants, experimental inoculations with which produced characteristic symptoms.

BAKER (R. E. D.). **Witches' broom disease investigations III. Notes on the occurrence of witches' broom disease of Cacao at River Estate, 1939–1942.**—*Trop. Agriculture, Trin.*, xx, 1, pp. 5–12, 1943.

In the course of further studies on the witches' broom disease of cacao in Trinidad [*Marasmius perniciosus*: *R.A.M.*, xxii, p. 128] disease records were taken from September, 1939, to September, 1942, at River Estate, Diego Martin, on a plot of eight-year-old trees, 76 representing the open-pollinated seedling progeny of the selection I.C.S. 1. The disease is stated to have increased in severity and by 1942 severely damaged and rendered unproductive several trees on this property; yet it is believed that the disease has not yet reached its maximum intensity. At the same time,

the effect of the extremely dry seasons of 1941 and 1942 made it impossible to distinguish between the amount of damage caused by drought and that caused by witches' broom. By October, 1942, the preceding months having been abnormally wet, the incidence of the disease was already nearly double that present twelve months earlier and as high as the previous year's maximum, which occurred in December, 1941–January, 1942. The rate of production of sporophores, on which the intensity of the disease largely depends, having, in addition, become already very high, it was assumed that the disease situation would be worse still by January, 1943.

The trees were found to vary greatly in the number of brooms removed, but it was consistently observed that trees which produce many brooms (both the fan and the cushion types) one year are likely to do so again the next year, and that trees which produce only a few brooms one year are likely to do so again the next year. Close correlation was found to exist between cushion brooms and flower production, but none between fan-brooms and flush or between cushion-brooms and fan-brooms. It is concluded from these data that if there is a resistance to the disease in Trinidad cacao, it is unlikely to be an inherent protoplasmic one but more probably one based on some form of disease avoidance on the part of the tree. It is suggested that some purely morphological character might account for the resistance, and that a tree showing resistance to fan-brooms might show no comparable resistance to cushion-brooms or to pod infection. Very few data have as yet been collected on the question of pod resistance. It is emphasized, nevertheless, that even trees showing resistance to fan-brooms only would be of considerable value in combating the disease. Incomplete data collected during the last year of the present study showed that only 10 per cent. of the pods were attacked by witches' broom disease, the bulk of the crop having escaped infection because the majority of the pods had developed during dry weather when the disease was at a minimum. This advantage is, however, offset by the fact that dry season pods may be 25 to 50 per cent. smaller than those ripened in the wet season. There was no indication of a correlation between the number of diseased pods and either the total number of brooms or the number of cushion-brooms per tree. Records of sporophore formation showed that a positive correlation exists between the sporophore index (the number of sporophores produced by a random sample of 100 brooms) for a given week and the total number of brooms formed five weeks later, thus indicating strongly that the supply of spores is a major controlling factor in this disease.

ANDRÉN (F.). **Resultat från betningsförsök 1941.** [The results of disinfection experiments 1941.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1942*, 4, pp. 60–63; 5, pp. 70–72, 1942.

The results of cereal seed-grain disinfection experiments in Sweden in 1941, which were conducted on a similar scale to those of 1940 [*R.A.M.*, xix, p. 462], are summarized and tabulated. The average yield increases in the winter wheat crop from dusting, immersion, and sprinkling were 180, 145, and 145 kg. per ha., respectively. Bunt [*Tilletia caries* and *T. foetida*] was reduced to a minimum by most of the treatments, the average efficiency of which is rated at 99·6 per cent., among the best being fusariol 2948, betoxin 61, abavit-neu, and panogen dusts, the three first-named at 200 and the last at 175 gm. per kg., and uspulun, abavit, and germisan solutions (all at 0·125 per cent.). The average efficiency of the various preparations in the control of barley stripe [*Helminthosporium gramineum*] was computed at 97 per cent., absolute freedom from infection having been secured by 15 minutes' immersion in 0·125 per cent. fusariol 2115. Betoxin 61 and fusariol 2948 (300 gm. per kg.) were among the most effective of the preparations tested against loose smut of oats [*Ustilago avenae*]. On the other hand, conflicting results

were obtained in the trials with abavit-neu and [ceresan] U.T. 1875 b., hitherto completely reliable in the control of this disease.

Dickson (J. G.). **Scab of Wheat and Barley and its control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1599, 22 pp., 15 figs., 4 maps, 1942.

In this revised edition of a bulletin originally issued in 1929 [*R.A.M.*, ix, p. 172] the author states that in 1919 [in the United States] scab (*Gibberella saubinetii* [*G. zeae*]) caused losses to wheat alone estimated at about 80 million bush. The disease was destructive again in 1928 and 1935, especially to spring wheat and spring barley. In other years heavy damage has been incurred in local areas, notably in Illinois, Iowa, southern Wisconsin, southern Minnesota, and south-eastern South Dakota, as well as in Maryland, Virginia, and North Carolina. The disease is present from the Mississippi Valley eastward in greater or less abundance every year, while it is rare or absent in the semi-arid plains and inter-mountain districts. Along the northern border the temperatures are usually less favourable for attack than in the central parts. In wet seasons it frequently spreads westward into the prairies. Wheat losses are highest in the soft winter-wheat area. Barley losses are greatest in the more humid, southern parts of the spring-barley area. In addition to the severe losses in 1928 and 1935 local losses occurred in this area in every year, except during the drought years of 1934 and 1936. In years such as 1928, when spring barley was used to replant fields in which wheat had succumbed to winter injury, losses were often very high. Losses in maize and rye are sometimes heavy, but, in general, losses in oats are low.

Affected grain can be fed safely to cattle, sheep, and chickens, but not to pigs. Horses will not eat badly scabbed grain, and it should not be used in human food. As infected wheat or rye kernels can be removed by suitable cleaning machinery, scab in these grains is less objectionable than in barley.

The disease develops most readily in warm, moist weather. A warm, comparatively dry soil favours the development of the seedling blight stage on wheat, barley, rye, and oats, while a cold, dry soil favours it on maize.

Losses can be greatly reduced by cleaning up the crop residues or ploughing them under, crop rotation, and the use of resistant varieties and disease-free and treated seed.

Gorlenko (M. V.). **Modes of hibernation of mildew (Erysiphe graminis D. C.) on cereals.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxxv, 6, pp. 187–188, 1942.

In studies conducted in the Voronezh district from 1937 to 1941 it was found that different forms of *Erysiphe graminis* from different cereal hosts vary in their mode of hibernation. Thus, *E. g. tritici* overwinters on winter wheat plants in the form of brown cushions of mycelium. *E. g. hordei* similarly overwinters on winter-sown barley, and the area of injurious activity of this form is, therefore, associated with regions in which winter barley is grown on a large scale. *E. g. bromi*, a strictly specialized form attacking only *Bromus arvensis*, overwinters by means of numerous perithecia, thus adapting itself to the winter behaviour of its host, an annual plant with a short growing season. *E. g. agropyri* overwinters in the form of mycelium on *Agropyron repens*. *E. g. poae* was observed to form only the conidial stage on *Poa pratensis* and *P. silvestris*, migrating in the autumn to the rosettes, which outlive the winter, and hibernating on them, whereas on *P. bulbosa*, which dies by the end of summer, the fungus produced large numbers of perithecia. *E. g. dactylidis* overwinters on *Dactylis glomerata* in the form of mycelium in mild winters and in the form of perithecia in severe ones. It is concluded from these observations that the different forms of *E. graminis* differ not only in host range but also in their mode of hibernation, that their mode of hibernation is adapted to the biological peculiarities of the host plant, and that they tend to spend the shortest possible

time apart from the living tissues of the host. For instance, the ascus stage is absent from hosts which live through the winter, but develops rapidly and abundantly on hosts with a short growing season. On account of the existing differences in specialization and biology between the forms studied, it is suggested that the mixed species *E. graminis* be subdivided into several.

BOSE (A. B.). **Germination of ergot.**—*Curr. Sci.*, xi, 11, p. 439, 1 fig., 1942.

In sterilized moist sand in Petri dishes at 20° C. four sclerotia of *Claviceps purpurea* imported from Europe (ergot being unobtainable in India) were germinated at the Carmichael Medical College, Calcutta. In subsequent experiments under similar conditions with the species of *Claviceps* collected in the Simla Hills by P. Nath [*R.A.M.*, xxi, p. 206], one sclerotium germinated after seven days, bearing on a slender, yellowish stalk a stroma containing mature perithecia with asci and filiform ascospores, the further development of which could not, however, be followed up.

Innovations in spray apparatus.—*Calif. Citrogr.*, xxviii, 3, p. 61, 5 figs., 1943.

As a result of the war-time labour shortage Californian citrus-growers are making increased use of mechanized spraying devices, including a mechanically oscillating straight boom, a 15-nozzle oscillating angular boom, semi-stationary 3- or 4-nozzle boom attachments for skirt spraying, and a movable boom, operated from the driver's seat, in which three nozzles revolve. It is stated to be too early to compare the results of these experimental machines with ordinary spray rigs.

PARKER (E. R.) & SOUTHWICK (R. W.). **Manganese deficiency in Citrus.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 51–58, 1 fig., 1941.

This is a survey of the available information on manganese deficiency of citrus in California, most of which has already been noticed from other sources [*R.A.M.*, xix, p. 338]. Except in the case of very severely affected orange and grapefruit trees, which had undergone premature defoliation, there was no obvious improvement during a two-year experimental period in the health or yield of trees in which leaf symptoms of manganese deficiency were eliminated by spraying with manganese mixtures. The admixture in the spray of soda ash (a hydrated lime), in quantities equivalent to half the weight of manganese sulphate used, is advocated to prevent leaf burning, and it was found that sprays containing about 3 lb. manganese sulphate per 100 gals. water were as effective as more concentrated mixtures.

BARDUCCI (T. B.) & RADA (G. G.). **El Verticillium-wilt del Algodonero.** [The *Verticillium* wilt of Cotton.]—*Bol. Estac. exp. agríc. La Molina* 23, 46 pp., 16 figs., 4 graphs, 1942.

The species of *Verticillium* responsible for cotton wilt in Peru [*R.A.M.*, xix, p. 263; xxi, p. 517] has been determined as *V. albo-atrum*, the optimum temperature and hydrogen-ion concentration for which in cultures on Czapek's, potato dextrose, and potato peptone dextrose agars were found to be 22° C. and P_H 7, respectively. The pathogen, which produces a systemic disease in its host, may easily be isolated from fresh material, the tips of the plant and of the branches and the secondary rootlets yielding the maximum percentages of fungal colonies (43·7, 59·5, and 43·4, respectively, compared with 34·3, 26, and 6·2 for the petioles, boll peduncles, and tap-root, respectively).

DESCHIENS (R.). **Milieux de culture à rendement élevé pour la récolte des spores d'Hyphomycètes prédateurs de Nématodes.** [Culture media for the production of heavy crops of the spores of Hyphomycetes preying on Nematodes.]—*Bull. Soc. Path. exot.*, xxxv, 6–8, pp. 237–241, 1942.

Details are given of the preparation and utilization of two substrata which have

produced luxuriant yields of spores of the species of *Arthrobotrys*, *Dactylella*, *Dactylaria*, and *Stylopage* preying on nematodes of the genera *Rhabditoidea*, *Strongyloidea*, *Trichostrongyloidea*, and *Metastrongyloidea*, parasites of man, animals, and cultivated plants [*R.A.M.*, xix, p. 149]. One is composed of 5 gm. each of oats chaff and malt extract, 12 to 15 gm. agar, and 1,000 c.c. distilled water (P_H 5·4 to 5·6), and the other of the same ingredients minus the chaff. At a temperature of 25° C., an abundant crop of spores is produced on the former medium in 60 to 80 days and on the latter in 80 to 100: the period of viability is one year. Before application in powder form to the soil or compost heap, the spores are dried in the open air or at 37°. To be effective, the powdered inoculum must be applied at the rate of 5 to 10 gm. per sq.m. soil, this being the approximate yield of a quarter of a Roux tube. The author envisages the extended use of predatory fungi for the prophylaxis of human and animal helminthiases and plant eelworms.

FARRELL (W. A.). **Bronchomoniliasis.**—*Canad. med. Ass. J.*, xlviii, 1, pp. 28–30, 2 figs., 1943.

The yeast-like fungus isolated from cultures of the sputum of a 23-year-old gold-miner suffering from an obscure pulmonary disease at Fort William, Ontario, fermented glucose, levulose, arabinose, and maltose (slightly), evolved acid from milk, which was coagulated, but did not liquefy gelatine. On the basis of these biological characters the organism was identified as *Monilia nabarroi* Cast.

SAMPSON (B. F.) & FARREN (J. E.). **Another case of Torula meningitis.**—*S. Afr. med. J.*, xvi, 13, pp. 245–247, 5 figs., 1942.

A point of mycological interest, believed to be here recorded for the first time, in connexion with the third case of meningitis due to *Torula histolytica* [*Debaryomyces neoformans*] in South Africa [*R.A.M.*, xix, p. 536], is the occurrence of the torules in family units or groups, united by mucoid material surrounding the older cells, the proximal part of which takes the Gram stain and is surrounded by an orange halo. The youngest members of the family stain Gram-positive and resemble a watermelon seed in shape; they grow readily on maltose or even on plain agar, but the cells produced under artificial conditions are not provided with the mucoid coats observed in the natural state.

SCHENKEN (J. R.) & PALIK (E. E.). **Coccidioidomycosis in States other than California, with report of a case in Louisiana.**—*Arch. Path.*, xxxiv, 3, pp. 484–494, 1 fig., 1942.

A feature of special interest in this report of a case of coccidioidal granuloma (*Coccidioides immitis*) in a 33-year-old negro of New Orleans, who is believed to have contracted the disease while picking fruit in California, is the exceptionally large dimension of the spherules, averaging 25 to 75 μ and reaching a maximum of 262 μ in diameter; the endospores measured 11 to 38 μ.

The geographical distribution of coccidioidomycosis is discussed and a table given showing particulars of the occurrence of 27 cases in States other than California.

DILLMAN (A. C.). **Breeding Flax resistant to rust.**—*Oil Paint Drug Rep.*, cxlii, 17, pp. 4, 40 B, 1 fig., 1942.

Despite heavy damage by rust [*Melampsora lini*], the 1942 United States flax crop was the largest on record, being estimated at 42,500,000 bush. In some localities the disease caused a reduction of 50 per cent. and upwards in output of the susceptible Bison, which in a comparative test of 25 varieties at Fargo, North Dakota [*R.A.M.*, xxi, p. 418] yielded only 13 bush. per acre as against a harvest

of 21 to 27 bush. from 18 new resistant types. Another undesirable feature of Bison is the inferior drying quality of its oil (low iodine number), and efforts are being made at the Minnesota, North Dakota, and Montana Agricultural Experiment Stations to overcome this and other defects by breeding. Several new strains combining superior oil quality with resistance to *M. lini* have, in fact, been developed, but, since the seed of these varieties will not be available for commercial cultivation in 1943, growers should procure the best sorts at present on the market, e.g., Viking, and (especially if the use of Bison is unavoidable) observe such sanitary precautions as thorough cleansing of the seed, the ploughing-under or burning of loose straw or standing stubble, crop rotation, planting old seed (1940 or 1941), which is unlikely to harbour viable spores of the rust, and early sowing. The spread of *M. lini* is liable to be arrested by a spell of dry weather with daily temperatures above 85° F., but in 1942 the prevailing rainy and cool conditions favoured the pathogen.

COLHOUN (J.) & MUSKETT (A. E.). **'Pasmo' disease of Flax.**—*Nature, Lond.*, cli, 3825, pp. 223–224, 2 figs., 1943.

When flax plants in the flowering stage were sprayed with a spore suspension of a fungus resembling *Sphaerella linorum* sent from Kenya [I.M.I. Map 18], by Nattrass, who stated that the fungus had been isolated from flax plants suspected of being attacked by 'pasmo' disease, lesions characteristic of this disease appeared on the plants 14 days later. The organism was re-isolated from pycnidia produced on the lesions, and was again inoculated into healthy flax, positive results again being obtained, and the organism again being re-isolated. Infection resulted from inoculations made both under glasshouse and open-air conditions.

The lesions produced appeared on leaves and stems, chiefly on the upper portions of the plants, and were brown, small, elongated, extending only part of the way round the stem; later on they enlarged and encircled the stem. Diseased and healthy portions commonly alternated on one and the same stem. The part above the encircling lesions was often killed by 'strangling'. In some instances the stem lesions somewhat resembled those produced by *Polyspora lini*, but the production of pycnidia in the case of 'pasmo' disease is sufficient to distinguish it. The minute, cream-coloured, acervuli produced by *P. lini* are not often found in the field, but are readily produced when infected stems are incubated.

As 'pasmo' disease has not yet been found in Great Britain, the utmost care must be taken to ensure that imported flax seed is uncontaminated.

SCHÖNLEBER (K[LARA]). **Untersuchungen über den zerstörenden Einfluss von Mikro-organismen auf verschiedenartig gelagerte künstliche Fasern.** [Investigations on the destructive influence of micro-organisms on synthetic fibres stored under varying conditions.]—*Zellwolle–Kunstseide–Seide*, xlvi, 9, pp. 336–342; 10, pp. 386–399, 37 figs., 1941. [Abs. in *Holz Roh- u. Werkstoff*, v, 9, p. 331, 1942.]

All kinds of synthetic fibres stored in a saturated atmosphere (100 per cent. atmospheric humidity) but not in one of 65 per cent. humidity are liable to disorganization by bacteria and fungi, the latter represented chiefly by *Aspergillus* and *Penicillium* spp. [*R.A.M.*, xx, p. 588], this group of organisms being mainly responsible for the destruction of fibres manufactured from cellulose, whereas bacteria play a more prominent part in the disintegration of material prepared from casein.

ASHWORTH (D[OROTHY]). **A Papulaspora-like fungus from Tulip bulbs.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 441, 1942.

The author records the occurrence of a *Papulaspora* isolated from tulip bulbs at

the Royal Horticultural Society's Laboratory at Wisley some 15 years ago. No evidence of pathogenicity was obtained at the time. Reasons were advanced for placing the fungus in the genus *Papulaspora*, but no specific name was suggested.

FISCHER (R.). **Der Lackschorf der Gladiole.** [The lacquer scab of Gladiolus.]—*Kranke Pflanze*, xix, 7–8, pp. 73–75, 1942.

This is a popular note on the three forms of disease associated in Germany and Austria with the infection of gladiolus by *Bacterium marginatum*, viz., 'lacquer scab', the name applied to the brown, cup-shaped depressions with a rubbery coating on the corms, 'brown pustules' on the foliage, and 'foot rot' of the basal leaves. Of these, the 'brown pustule' phase is promoted by heavy rainfall or injudicious watering, while damp, heavy soils are conducive to 'lacquer scab' and 'foot rot', of which the latter is the more serious and terminates fatally, whereas diseased corms, transferred to a dry site, may give rise to completely healthy 'daughter' corms. The corms developing from foot-rotted plants should be lifted from the soil and burnt or buried in deep pits with an admixture of caustic lime, while other precautions against the spread of infection should include a regular change of planting site, the use of healthy corms, the removal of infected parts with a knife, overwintering of the corms in a fairly dry atmosphere, and their antiseptic treatment for 30 to 60 minutes in an emulsion of a standard fungicide, such as 0·5 per cent. mercuric chloride mixed with 0·5 kg. loam per l., before being laid out to dry.

STUART (N. W.) & MCCLELLAN (W. D.). **Severity of Narcissus basal rot increased by the use of synthetic hormones and nitrogen bases.**—*Science*, N.S., xcvii, 2505, p. 15, 1943.

During the past two years investigations have been carried out at the Bureau of Plant Industry Station, Beltsville, Maryland, in which King Alfred narcissus [daffodil: *Narcissus pseudonarcissus*] bulbs were dipped before planting in the autumn in solutions containing 10 to 100 p.p.m of naphthalene acetamide, indolebutyric acid, indoleacetic acid, naphthaleneacetic acid, uric acid, guanidine, and allantoin, or in talcum powder containing 1 to 10 parts of these compounds in 5,000 parts of talcum. Several thousand bulbs were planted, and in every trial the treatment increased the amount of basal rot (*Fusarium oxysporum* f. *narcissi*) [*F. bulbigenum*]. Apparently healthy bulbs treated after harvest with several of these compounds developed a significant increase in the amount of basal rot during storage.

In laboratory studies the addition of napthalene acetamide, indolebutyric acid, allantoin, uric acid, and adenine sulphate stimulated the growth of the fungus.

This is believed to be the first report of the stimulation of a plant pathogen by a synthetic growth-regulating substance of the hormone type or by a nitrogen base. Further studies are in progress.

SMITH (F. F.) & WEISS (F.). **Relationship of insects to the spread of Azalea flower spot.**—*Tech. Bull. U.S. Dep. Agric.* 798, 43 pp., 8 figs., 1942.

In studies carried out from 1934 to 1938, inclusive, infection of azalea [*Rhododendron*] by flower spot (*Ovulinia azaleae*) [*R.A.M.*, xx, p. 119] was obtained through the agency of honey bees (*Apis mellifica*), five species of bumblebees (*Bombus americanorum*, *B. bimaculatus*, *B. fraternus*, *B. griseocollis*, and *B. impatiens*), two species of carpenter bees (*Xylocopa micans* and *X. virginica*), three solitary bees (*Emphoropsis floridana*, *Osmia lignaria*, and *Tetralonia rosae*), one thrips (*Heterothrips azaleae*), three ants (*Crematogaster ashmeadi*, *Pheidole morrisi* var. *vanceae*, and *Prenolepis imparis*), and a fly (*Hylemya* sp.). Infections were obtained with heads and legs of *A. mellifica*, *B.* spp., *E. floridana*, *O. lignaria*, and

X. spp., but in no instance with pollen, even when taken from infective insects and though spores were present among the pollen grains.

During the flowering periods of 1937 and 1938 the infectivity of the insects was ascertained to vary with the season. At first, the usual vectors were not present, except honey bees, and these did not produce infection, while other insects present also failed to cause disease. Primary infections developed on the flowers to the limp-blight stage before any insect gave rise to infection experimentally. As the disease became more general, the infectivity of the insects increased, reaching a maximum while the flowers were drying after a wave of general infection and the development of limp blight.

In work carried out to determine the source of primary infection, honey bees and other insects present early in the season were not found to bring the fungus from their winter quarters or from other flowers. Primary infections were most commonly present near the soil, and flowers splashed with water and soil became diseased. Soil-inhabiting animals and insects did not cause infection until after the disease had appeared in azalea gardens.

Other evidence demonstrated that an infective insect loses its spore load gradually and is able to infect at least ten flowers. Insects transmitted the disease to a distance of two miles, and marked bees were recaptured five miles away. Infection was also obtained on *R. nudiflorum*, a widely distributed native plant.

Infections caused by insects were reduced by 68·6 per cent. by means of a fungicidal dust containing 20 per cent. monohydrated copper sulphate and 80 per cent. kaolin. On the dusted flowers there were 47·6 per cent. fewer insects that caused infection. A fungicidal spray containing acetic acid only repelled insects when the flowers were wet with it.

It is concluded that although insects are sometimes effective vectors of the disease, they are not primarily responsible for its development once it has become established in a planting. They may, however, be concerned in its spread to other azalea plantings in the locality. The most sensible means of dealing with the problem would appear to consist in controlling the disease rather than the insects.

DOSDALL (LOUISE). **How to keep disease out of the Peonies.**—*Minn. Hort.*, lxx, 8, pp. 141–142, 1942.

Practical recommendations are made for the exclusion from peony plantings of four fungal blights, all of which were troublesome in Minnesota during the continuously wet growing season of 1942, viz., *Phytophthora* [*paeoniae*], *Botrytis* [*paeoniae*], *Cladosporium* [*paeoniae*], and *Septoria* [*paeoniae*: *R.A.M.*, xv, p. 99], the three last-named being restricted to the host in question. Stringent sanitation is the most important step towards the control of all the diseases and should comprise the cutting-down of the stems in the autumn as near as possible to the buds without injuring them and burning the refuse, followed in the spring by the excision and burning of any newly infected material. Spraying or dusting with Bordeaux mixture against *P. paeoniae* should be commenced when the shoots are about 6 in. in height and repeated (under humid conditions) at weekly to ten-day intervals until the buds begin to show colour. At least two treatments should be given after the flowers are cut to prevent infection by the other three fungi, infection by which, in contrast to the *Phytophthora* blight, may occur later in the season. Attacks by *P. paeoniae* and *B. paeoniae* are often followed by root rots, which necessitate the transference of the plants to fresh sites in a sunny, airy position on well-drained soil. After division and cutting away the rotted tissues, the roots intended for re-planting should be immersed in 0·25 per cent. semesan. Another wise precaution consists in placing 2 to 3 in. coarse sand round the roots.

CASTLE (H.) & NICKELL (L. G.). **The aerosol-hypochlorite technique for the sterilization of Orchid seeds.**—*Bull. Amer. Orchid Soc.*, xi, pp. 200–201, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 1, p. 214, 1943.]

Complete sterilization of orchid seed, without injury, was achieved by the transference of a sufficient quantity of seed for one or two germination flasks to a sterilization tube by means of a small platinum loop, washing the seed to the bottom of the tube with three drops of aerosol solution (prepared by adding one drop of 25 per cent. O.T. Clear aerosol to 25 ml. water), adding three drops of freshly prepared calcium hypochlorite solution (obtained by digesting 2 gm. of the compound in 28 c.c. water for ten minutes and filtering), and stirring occasionally for five minutes.

PORTER (J. N.). **Investigations on Orchid mycorrhiza.**—*Summ. Theses Ph.D. Harv., 1940*, pp. 72–74, 1942.

Three general lines were followed by the writer in his study of orchid mycorrhiza, namely (1) the germination of *Paphiopedilum* seeds, (2) the mycorrhiza of *Zeuxine strateumatica*, an account of which has already been noticed from another source [*R.A.M.*, xxii, p. 75], and (3) the associations between mycorrhizal fungi and representative orchids, including a number of Guatemalan species investigated in their native habitats in 1938.

The results of sowing *P.* seeds on Burgeff's asymbiotic medium were generally negative, but the addition of an aqueous extract from lentils tended to promote germination. Some evidence was obtained pointing to the desirability of further experiments with alcoholic vitamin extracts and on the effects of wetting and drying the seeds. Although different isolates of *Rhizoctonia repens* [ibid., xvi, p. 47], the mycorrhizal partner of *Paphiopedilum*, varied in their capacity for the promotion of germination in the orchid, and likewise hybrids of the host of diverse origin showed varying degrees of ability to utilize the fungus, the results of symbiotic tests were generally far superior to those secured on the asymbiotic substratum.

All the fungi isolated from greenhouse orchids were identified as *R. repens*, but such were the divergences in physiological activity between the several isolates that almost every hybrid of *Paphiopedilum*, for instance, harbours a 'strain' differing somewhat from the rest in this respect, but not to any significant extent morphologically.

The organisms isolated from 17 out of 72 species of Guatemalan orchids were *R. repens*, *R. gracilis*, *R. stahlii*, and two undetermined *R.* spp., the connexion between certain genera of the hosts and particular species of the fungi being consistently specific, irrespective of altitude and regional differences in habitat. *R. repens* was further isolated from the native United States orchids *Goodyera pubescens* and *Spiranthes cernua*.

HYDE (E. O. C.). **Examination of Ryegrass seed for blind seed disease.**—*N.Z.J. Agric.*, lxv, 6, pp. 349–350, 1 fig., 1942.

New Zealand growers of rye-grass [*Lolium perenne* and *L. multiflorum*] seed who desire to have their seed examined as it approaches maturity for the presence of blind seed disease [*Phialea mucosa*: *R.A.M.*, xxi, p. 455] are advised to take a sample during the week preceding cutting, at a time when the grass is not wet with rain or dew. In order that the sample may be adequately representative of the whole crop, it must consist of seed heads from many points scattered throughout the field. These heads must be tied together, labelled, rolled in paper without delay, and promptly despatched to the Seed Testing Station, Palmerston North.

Christopher (E. P.). **Influence of time of harvest on storage scald development of Rhode Island Greening and Cortland Apples.**—Abs. in *Proc. Amer. Soc. hort. Sci.*, xxxix, p. 58, 1941.

Three years' trials at the Rhode Island Agricultural Experiment Station showed that delaying the harvesting of Rhode Island Greening apples until late September and of Cortlands up to mid-October reduced the risk of storage scald in these varieties [*R.A.M.*, xxi, p. 457]. In the former, seasonal and soil fertility conditions also played a part in the development of storage scald, whereas time of harvest was the only variable factor involved with Cortland. The beneficial effects of a postponement in the picking date were chiefly apparent during the early part of the storage period.

Christopher (E. P.). **Influence of sulphur sprays on the trunk diameter of young Apple trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 8–10, 1941.

Particulars are given of experiments to determine the comparative effects of lime-sulphur sprays, flotation sulphur paste, and sulphur dust on the trunk growth increments of McIntosh and Baldwin apples at Kingston, Rhode Island [cf. *R.A.M.*, xiii, p. 310]. In 1939 the one-year-old whips from a Maryland nursery were given four treatments, beginning on 6th June, while in 1940 five applications were made, commencing on 27th May. Scab [*Venturia inaequalis*] was almost absent in the former year but severe in the latter. In November, 1940, when the trunk diameters were measured, the girth of the McIntosh whips 1 ft. above soil-level was found to range from 1·176 in. (lime-sulphur 1 in 50) to 1·336 in. (sulphur dust), that for the untreated control being 1·226 in., the figures for the Baldwins ranging from 1·176 in. (lime-sulphur 1 in 50) to 1·368 in. (lime-sulphur 1 in 100) the control being 1·208 in., and sulphur dust 1·346 in., respectively.

Kawamura (E.). **Studies on Gymnosporangium haraeanum Syd. II. The rôle played by insects in the transfer of spermatia in the fungus.**—*Ann. phytopath. Soc. Japan*, x, 4, pp. 297–303, 1 fig., 1941.

Continuing his studies on the pear rust (*Gymnosporangium haraeanum*) at the Kagosima College of Agriculture and Forestry [*R.A.M.*, xx, p. 477], the writer found that the nectar secreted from the pustules on pear leaves contains reducing sugar and tastes sweetish, but is without perceptible odour. By covering the infected leaves with cheese-cloth and thus preventing the free access of insects to the pustules, the formation of aecidia was reduced to half in field tests compared with the number developing on uncovered foliage. Besides the house fly, *Eristalis cerealis* Fabricius, *Calliphora erythrocephala* Meigen and *Iridomyrmex itoi* Forel were shown to mix the nectars of separate pustules, thereby inducing the formation of the aecidial stage of the rust, while the same species and a number of others [which are enumerated] were observed to visit the pustules on pear leaves in the vicinity of Hukuoka and transfer the spermatia from one pustule to another. Flies were more abundant than ants on the diseased foliage. The duration of the period of secretion of nectar from sterile pustules was longer than that elapsing in the case of fertilized ones.

Leach (R.). **Soil conditions affecting production of perithecia in Banana leaf spot disease.**—*Nature, Lond.*, cli, 3824, p. 199, 1943.

In a few isolated areas of Jamaica perithecia of the banana leaf-spot fungus, *Mycosphaerella musicola* [*R.A.M.*, xx, p. 412], were observed to form in profusion throughout the year, and not only during the limited season from August to January as in most other districts [ibid., xxi, p. 381]. It was found that this abnormal production of perithecia is positively correlated with the growth of the banana on highly acid soils (P_H 4·0 to 4·75 approximately). Normal three-weekly spraying

[loc. cit.] failed to control the disease in these areas at any time of the year. Satisfactory results were obtained only with weekly heart-leaf spraying, but this method is stated to be impracticable once the plants have grown tall. It is considered that spraying may prove generally uneconomic unless liming or some other means are found to ameliorate the effect of high soil acidity. No explanation has as yet been found for this abnormal production of perithecia, although it is thought possible that the water relationship of the soil may play a part in it.

GREGORY (P. H.). **Dissemination of fungus spores in air.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 442, 1942.

Investigations on the air transmission of fungus pathogens to new areas are mostly concerned with how far and how high spores are transported by air currents. Comparatively little is recorded of the number of spores deposited within short distances. Under field conditions the relation between degree of infection and distance from an infected field may be important, and from the fact that printed observations on a number of diseases are in agreement with Stepanoff's formula [*R.A.M.*, xv, p. 384] it is thought that dissemination of spores in air may be measured quantitatively.

LARGE (E. C.). **Control of Potato blight (Phytophthora infestans) by spraying with suspensions of metallic copper.**—*Nature, Lond.*, cli, 3820, pp. 80–81, 1943.

In tests with suspensions of metallic copper against potato blight (*Phytophthora infestans*), Arran Banner potatoes at Bude, Cornwall, and Majestic potatoes at Dartington and Kentisbeare, Devon, were sprayed with cuprous oxide and hydrogen-reduced copper, both with added bentonite, Bordeaux mixture also being used for comparative purposes. All the sprays contained 0·25 per cent. copper by weight, and two applications were made, at the rates of 110 and 140 gals. per acre, respectively. Dispersal of the copper particles was secured by trituration of the reduced copper, dry or moist, with a mixture containing 97 parts of bentonite, 2 parts of aluminium sulphate, and 1 part of soda ash, by weight.

In all three areas severe blight was experienced, but the metallic copper sprays, though somewhat less effective than Bordeaux mixture, kept the plants green three weeks after the unsprayed had died, and throughout the experiment gave such good control of leaf infection as to demonstrate quite definitely that metallic copper possesses strong fungicidal powers against *P. infestans*.

The mean total yields of tubers for the three localities, respectively, in tons per acre, were 14·4, 14·3, and 16·1 for the Bordeaux mixture, 15·4, 14·3, and 14·7 for the cuprous oxide plus bentonite, 13·8, 14·6, and 14·3 for the hydrogen-reduced copper plus bentonite, and 10·6, 11·1, and 11·6 for the unsprayed controls.

Plant diseases. Diseases of Potatoes.—*Agric. Gaz. N.S.W.*, lii, 12, pp. 571–578, 581, 22 figs., 1942.

Brief, popular notes are given descriptive of the chief potato diseases present in New South Wales, with hints on their control by seed selection and disinfection with mercuric chloride, and crop rotation; spraying with Bordeaux mixture is a routine practice in some areas where late blight [*Phytophthora infestans*] occurs almost every year. The spotted wilt or 'bronze' disease virus [*R.A.M.*, xxi, p. 244] is spread from diseased to healthy plants by thrips [*Frankliniella insularis*: ibid., x, p. 66]. Brown, dead spots or rings appear on the leaves, and the younger ones may be killed. Infection spreads to the shoot apex, causing blighting and death. The severity of the symptoms depends on the age of the plant at the time of attack. Old leaves may show only zoned, brown spots.

FAWCETT (G. L.). **La podredumbre negra de las Papas en Tucumán.** [The black rot of Potatoes in Tucumán.]—*Rev. industr. agríc. Tucumán*, xxxii, 4–6, p. 162, 1942.

The most destructive disease of potatoes in Tucumán is the so-called 'black rot' [late blight] caused by *Phytophthora infestans*, the extension of which in the Province of recent years is probably attributable to the use of infected seed. Under conditions favouring the pathogen, including temperatures ranging from 15° to 20° C., poor soil, and excessive humidity, a stand may be ruined in less than a week from the onset of the disease following a few days' steady rain. Plantings made in February and March are often a failure owing to the ravages of *P. infestans*, encouraged by cold and wet autumn weather, whereas those of July to September, maturing at a relatively dry period, are usually free from infection. Spraying with 0·75 to 1 per cent. Bordeaux mixture is the sole means of control, the first application being made when the plants attain a height of 10 to 15 cm. and the next a week or ten days later, a third treatment being required only if humid conditions develop.

BAILEY (H. L.). **Report on the Division of Plant Pest Control.**—*Rep. Vt agric. Exp. Sta., 1941–1942*, pp. 43–51, 1942. [Varityped.]

The following references to potato disease work occur on pp. 48–50 of this report. The first cases of bacterial ring rot [*Corynebacterium sepedonicum*] in Vermont were detected in Essex County in the summer of 1940, other centres being subsequently located in Orleans and Lamoille Counties, as well as in a stored lot. Three of the cases were traced back to a single car-load of seed imported in 1939. In 1941 two further cases, apparently originating from the same source, were observed and a new focus was located in Chittenden County, also from imported seed. The Gram-stain method of determination afforded definite evidence as to the identity of the pathogen.

Black leg [*Erwinia phytophthora*] was more abundant than for many years past, but recent studies have shown this disease to be much less important from the seed-certification angle than was formerly supposed. In the writer's opinion the present tolerances of 2 and 1 per cent. for the first and second inspections, respectively, might well be lifted and the amount of permissible infection left to the inspector's discretion.

On the other hand, the present leaf-roll tolerance is 3 per cent. (first inspection), while that for net necrosis is 5 per cent. and the reduction of both these requires consideration.

KRÜGER (E.). **Untersuchungen über den Einfluss von Elektrolyten und Nichtelektrolyten auf die Sporangienkeimung und die Differenzierung der Zoosporen bei Phytophthora infestans.** [Studies on the influence of electrolytes and non-electrolytes on the sporangial germination and differentiation of the zoospores in *Phytophthora infestans*.]—*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, pp. 51–95, 1940. [Abs. in *Z. PflKrankh.*, lii, 11, pp. 521–522, 1942.]

Pure water was found to be more effective than any of the organic and inorganic chemical compounds tested by the writer for the differentiation into zoospores of the sporangial plasma of *Phytophthora infestans*. Although copper exerted the strongest inhibitory effect on zoospore formation, other heavy metals, notably iron, were not without influence in this direction and might possibly be used as substitutes for copper. The organic materials used in the trials were less toxic to the zoospores than the metal salts. The efficacy of a given substance increases with its penetrative capacity.

ELMER (O. H.). **Effect of environment on the prevalence of soil-borne Rhizoctonia.**—*Phytopathology*, xxxii, 11, pp. 972–977, 1 graph, 1942.

During an investigation covering a 13-year period (1927 to 1940) on the pre-

valence of soil-borne infection of potatoes by *Rhizoctonia* disease (*Corticium vagum*) [*C. solani*] in Kansas, wide fluctuations were observed, the pathogen being capable of saprophytic survival only in seasons with a sufficient summer rainfall to prevent its desiccation and death in the mycelial stage. Sclerotia were absent during the critical months of July and August, since their production demands cooler conditions than those usually obtaining in the State at that time of year. The incidence of infection reached a maximum of 53·2 per cent. in 1928, when the precipitation in July and August was 2·75 and 4·91 in., respectively, the average daily maximum temperatures 87·8° and 87·6° F., respectively, and the wind, measured as total miles per month, 5,330 and 5,454, respectively, and fell to a minimum of 1·1, 1·1, and 1·3 per cent. in 1935, 1938, and 1939, respectively, when the July and August rainfalls were 0·03 and 3·98, 3·97 and 2·15, and 1·26 and 3·51 in., respectively, the corresponding temperatures 99·7° and 91·6°, 94° and 96·2°, and 99·1° and 89·3°, respectively, and the wind 6,205 and 6,160, 5,610 and 7,299, and 6,759 and 6,198 miles, respectively.

As a parasite, on the other hand, *C. solani* can persist on infected host plants under conditions too dry to admit of its survival saprophytically in the soil, and it was repeatedly observed in the course of these experiments that the amount of *C. solani* in potato field soils was large following an autumn crop of potatoes, vetch, or cowpeas, the two latter being sown as 'fertility' crops in the preceding summer or autumn.

Stevenson (F. J.), Schaal (L. A.), Clark (C. F.), & Akeley (R. V.). **Potato-scab gardens in the United States.**—*Phytopathology*, xxxii, 11, pp. 965–971, 1942.

Highly significant differences in their reactions to the agent of common scab (*Actinomyces scabies*) as regards pustule type and tuber-surface coverage were shown by the 22 potato varieties tested by the authors and their collaborators in four scab gardens in Maine, Colorado, Minnesota, and Michigan in 1939 and 1940 [*R.A.M.*, xviii, p. 340]. The type of pustule, viz., (1) relatively large and deep, (2) relatively large but shallow, (3) small and superficial, and the proportion of tuber surface covered (falling into six classes ranging between 0 to 1 and 81 to 100 per cent.) were closely correlated, indicating that in most cases the comparative responses of the varieties to scab infection could be gauged by either criterion. Generally speaking, the varietal reactions, especially among the more resistant sorts, were quite constant in both years and in the four localities. The interactions between variety and place of cultivation were significant and might have been attributable either to environmental factors or physiologic races of the fungus, or both—probably the former in view of the marked influence of the locality and season on the type of pustule. The deepest pustules, usually considered to indicate susceptibility, were shown by Houma followed by 1037–5, Sebago, and AAO–9 while the shallowest were found on Hindenburg, Richter's Jubel, 256–11, and 528–242. Houma was also the most susceptible of the experimental varieties judging by the extent of the tuber surface covered with scab pustules (mean percentage in 16 tests 50), followed by AAO–9 and Sebago, with 37·5 and 33·8, respectively, while the most resistant were 627–164, Richter's Jubel, and Hindenburg (3·5, 4·7, and 5·3, respectively).

From the results of these trials it seems probable that resistant selections originating in Maine will react similarly to *A. scabies* in other parts of the country, but further tests of longer duration and wider scope are necessary before a final decision on this point can be reached.

Keyworth (W. G.). **Verticillium wilt of Hops.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 440, 1942.

The results of detailed studies of the wilt disease of hop (*Verticillium albo-atrum*

and *V. dahliae*), of which altogether 72 outbreaks have so far been reported, have already been noticed from another source [*R.A.M.*, xxii, p. 112].

Discussion on mycological nomenclature, 21 February 1942.—*Trans. Brit. mycol. Soc.*, xxv, 4, pp. 428–439, 1942.

At the meeting of the British Mycological Society in London on 21st February, 1942, the following members took part in a discussion on mycological nomenclature. E. M. Wakefield reviewed the history of nomenclature and explained the application of the present Rules. E. W. Mason entered into the question of obligate and facultative synonyms. G. R. Bisby spoke about the citation of authors and proposed some alteration of the present Rules. J. Ramsbottom concluded the discussion by dwelling on some of the points made by the previous speakers and by stressing the importance of the distinction between taxonomy and nomenclature.

Service and regulatory announcements. List of intercepted plant pests, 1941.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 50 pp., 1942.

In the notes accompanying these lists of the pests and diseases intercepted on plant products entering the United States from 1st July, 1940, to 30th June, 1941 [*R.A.M.*, xxi, p. 352] attention is drawn to the fact that *Bacterium* [*Xanthomonas*] *citri* [ibid., xx, p. 531] was intercepted on lime (*Citrus aurantifolia*) from the Dutch East Indies, Java, and the Philippines, on grapefruit from China, and on orange from China and Japan. *Elsinoe australis* [ibid., xxi, p. 369] occurred occasionally in citrus from Argentina and Brazil. Black spot (*Phoma citricarpa*) [ibid., xvi, p. 601] was found on citrus fruit from South Africa, where the disease is now established. Lima bean [*Phaseolus lunatus*] scab (*E. phaseoli*), so common on shipments from Cuba that it is listed among the common diseases [ibid., xx, p. 336], was seen more or less frequently. *Helminthosporium allii* [ibid., iv, p. 325], which occurs as dark mycelium and spores, especially on garlic from Mexico, also occurred so often that it is listed as a common disease. An organism new to these lists is *Dendrochium lycopersici*, hitherto known from Belgium, but now recorded on tomatoes from Mexico. One or more of the oriental strains of the *Lespedeza* rust (*Uromyces lespedezae-procumbentis*) [ibid., xiv, p. 516] were again intercepted with seed from Japan. Dutch elm disease (*Ceratostomella ulmi*) was again found on several lots of elm crating from England. A new disease, tentatively identified as due to *Sclerotinia kerneri*, a fir pathogen described from Austria and not known to occur in North America [cf. ibid., xxi, p. 355], was found on Christmas trees (*Abies balsamea*) from Newfoundland and on 'greens' (*Abies* sp.) from Nova Scotia. Other diseases listed are *Claviceps paspali* on *Paspalum* sp. from the Canal Zone and Costa Rica, potato spindle tuber from Peru, and tomato spotted wilt on tomatoes from Cuba and Mexico.

THOMPSON (MAUDE A.). **Cumulative index to service and regulatory announcements Nos. 1 to 149 inclusive, 1919–41.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 89 pp., 1942.

In response to the demand of administrative officers and inspectors for a complete cumulative index to the service and regulatory announcements published by the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, first at monthly and subsequently at quarterly intervals since 1914, the present compilation supplements the first 20-year index prepared by H. S. Dean in 1934 with material covering the period from 1934 to 1941, inclusive. Among the features of the work facilitating its consultation for purposes of reference may be mentioned the separate lists of each quarantine, with all title changes, revisions, amendments, and relevant administrative instructions, together with their effective dates.

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Vol. XXII | JUNE | 1943

Joshi (K. G.) & Panditrao (D. B.). **Albinism in Sugarcane.**—*Curr. Sci.*, xi, 10, pp. 402–403, 1942.

Attention is drawn to the occurrence of 'albinism' on the leaves of the Pounda variety of sugar-cane grown under sewage irrigation at Nagpur, India. White, slightly raised, yellow-bordered patches, 0·5 to 9 cm. in length, developed along the midribs on the under sides of the second to the ninth leaves, the intermediate ones being affected in some cases, while in others they were free from the defect. Slight discolorations on the upper surface corresponded to the 'albino' areas, which affected some 20 to 25 per cent. of the stands, without, however, impairing their general health. No evidence of insect, bacterial, or fungal invasion was revealed by a microscopic examination of the diseased areas, and the cause of the condition is under investigation.

Wakefield (E[lsie] M.) & Bisby (G. R.). **List of Hyphomycetes recorded for Britain. Supplementary note.**—*Trans. Brit. mycol. Soc.*, xxv, 4, p. 427, 1942.

The authors supply five corrections to their list [*R.A.M.*, xx, p. 495] and add several records which were made since its publication, as well as one, *Aspergillus restrictus*, causing mildew in cotton goods, which was omitted.

Dearness (J.) & House (H. D.). **New or noteworthy species of New York fungi. V.**—*Circ. N.Y. St. Mus.* 24, pp. 25–60, 1940. [Received February, 1943.]

This list [cf. *R.A.M.*, vi, p. 126; viii, p. 66], dealing with collections of fungi mainly from New York State, contains the names of 37 new species and 48 new records for the State, the fungi belonging to the Phycomycetes, Ascomycetes (chiefly Pyrenomycetes), Basidiomycetes, Sphaeropsidales, and Moniliales. Mention may be made of the following: *Phyllosticta dearnessii* on living and languishing leaves of *Rubus pubescens*; *P. destruens* on living leaves of *Prunus virginiana*; *Sphaeronema pithyum* on living and dying trunks of *Pinus strobus*, trees severely infected showing a general thinning of the foliage and a shortening of the needles, which are pale or yellowish; *Cytospora translucens* attacking small branches and twigs of *Salix alba*, causing the death of the leaves above the point of infection; *Macrosporium araliae* n. sp. on living leaves of *Aralia racemosa*, forming dark brown, irregular spots extending along the veins, with conidia very variable in shape, 10 to 30 μ in width, the spore body 30 to 120 μ in length, and the 'pedicels' 30 to 175 μ long; *Cercospora cichorii* on living and languishing chicory leaves; and *Fusarium episphaericum*, parasitic on the black knot fungus (*Dibotryon morbosum*) on *Prunus virginiana*.

Gäumann (E.). **Zur Kenntnis einiger Umbelliferen-Puccinien.** [A contribution to the knowledge of some *Pucciniae* on Umbelliferae.]—*Ber. schweiz. bot. Ges.*, li, pp. 143–164, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cv, 10–11, p. 194, 1942.]

Among the changes made in the taxonomic position of certain species of *Puccinia*

on Umbelliferae on the basis of statistical measurements may be mentioned the reference of *P. petroselini* [*R.A.M.*, xi, p. 73], *P. arethusae*, and *P. silai* to the collective species *P. bullata*.

MUNDKUR (B. B.). **Taxonomic studies of Indian smuts.**—*Anniv. Vol. R. bot. Gdn, Calcutta, 1942*, pp. 221–225, 1942.

This is a brief historical review of the smut collections made in India. Up to the end of the nineteenth century 20 representatives of this group of fungi had been discovered, of which 18 were new species. From 1904 to 1914 about 76 collections were made by Sir Edwin Butler, and these included 30 new species. By the end of 1938, the total number of smuts recorded for the country was 110, including seven new species in the 43 collections examined by the writer, who since then has proposed further new species and new combinations [*R.A.M.*, xviii, p. 627; xix, p. 237; xx, p. 179].

DAVIDSON (R. W.). **Some additional species of Ceratostomella in the United States.**—*Mycologia*, xxxiv, 6, pp. 650–662, 4 figs., 1942.

This list of species of *Ceratostomella* isolated from decayed wood, but as far as is known not associated with disease in the host, includes three new species, *C.* (*Ophiostoma*) *microspora*, *C.* (*Grosmannia*) *leptographioides*, and *C.* (*G.*) *rostrocylindrica*, and also *C. stenoceras* and *C. minutum*. The author expresses the opinion, based on a study of a considerable number of species of most known groups of the genus *Ceratostomella*, that neither the ostiolar filaments nor any other perithecial character can be used in separating the groups of this genus. Conidial stages are considered more reliable for placing the species in their natural groups. The endoconidial group has already been separated by the author and placed in the genus established by Münch [*Endoconidiophora*: *R.A.M.*, xiv, p. 729], and the *Leptographium* forms are believed to constitute a separate genus. The remaining species will probably prove, following further investigations, to represent a heterogeneous mixture of closely related groups and will then be placed in the genus *Ophiostoma*. It is pointed out, however, that whereas many species of *Ophiostoma*, *Grosmannia*, and *Endoconidiophora* groups have been carefully studied in pure culture, none of the species of *Ceratostomella* with persistent asci is known to have been studied in culture, and that it is possible, therefore, that there may not be distinct cultural differences between them.

LINDER (D. H.). **A contribution towards a monograph of the genus Oidium (Fungi Imperfecti).**—*Lloydia*, v, 3, pp. 165–207, 7 figs., 1942.

The present paper was begun as a monograph of the genus *Rhinotrichum*, but in the course of several years' studies the author arrived at the conclusion that this genus, in the sense of Corda, is untenable and must give way to *Oidium* Link, as typified by Corda's illustration of the type species under the name *Torula aurea* (Link) Corda. This concept of *Oidium* agrees with that adopted by Sumstine (*Mycologia*, v, pp. 45–61, 1913), although his method of distinguishing the two genera by their manner of spore production is not considered a reliable criterion. The first genus to be described which would include those species that are now treated in *Oidium*, is stated to be *Acladium* of Link, but the name cannot be used since Fries reduced *Acladium* to synonymy under *Sporotrichum*. Those species that have been allocated to this genus by medical mycologists must, therefore, be removed elsewhere. Other genera of the Fungi Imperfecti containing species more properly placed in *Oidium* as interpreted by the author, are *Monilia*, *Olpitrichum*, *Rhinocladium*, and *Zygodesmus*. The reasons advanced in favour of using *Oidium* in its original meaning are as follows: (1) the genus may readily be legally typified; (2) by thus typifying the genus, the way will be paved for accepting *Sporendonema*

of Desmazières for those forms represented by *Oidium* or *Oospora lactis* and *O. casei*, and *Acrosporium* of Nees for those species which are the conidial stages of the Erysiphaceae; (3) the number of name changes is not excessive; and (4) the plea of general usage is rejected on the grounds that the practice of conservation should be applied only when an original species or genus cannot be readily typified, or in those cases in which excessive name-changing would result in confusion harmful to the advance of botany as a whole.

The author gives an annotated list, with descriptions and synonyms, and a key, of the 31 species placed by him in the genus *Oidium*. With a few exceptions, these species are predominantly saprophytic and grow on decaying wood, occasionally on old fructifications of members of the Polyporaceae, or on the ground. Some at least are conidial states of Thelephoraceae. Notes are also given on excluded and doubtful species.

Jacques (J. E.). **Studies in the genus Heterosporium.**—*Contr. Inst. bot. Montréal* 39, 46 pp., 6 pl., 1941.

A comparative study of seven species of *Heterosporium*, viz., *H. iridis* (Faut. & Roum.) n. comb. (syn. *Scolecotrichum iridis*) [*H. gracile*], *H. phlei*, and *H. robiniae* (collected by the author near Ithaca, New York), *H. allii* and *H. ornithogali* (isolated from fresh material obtained from Illinois), and *H. echinulatum* and *H. variabile* (from the Centraalbureau voor Schimmelcultures, Baarn, Holland), examined in the living state on potato dextrose agar, prune agar, and sterilized portions of the leaves of suscepts, showed that they fell roughly into three groups. The first comprised *H. gracile* only, the dimensions of the conidiophores (primary portion 25 to 200 or more by 6 to 16 μ) and conidia (20 to 98 by 11 to 25 μ) of which were approached by none of the remaining species; the ascigerous stage of this species (*Didymellina macrospora*) is also characterized by very large reproductive structures. *H. gracile* appears to be very closely related to certain species of *Helminthosporium*; for example, *H. gramineum* would easily be confused with it, but for its roughened epispore.

The second subdivision, comprising *Heterosporium allii*, *H. echinulatum* (the imperfect stage of *D. dianthi*), and *H. ornithogali*, forms an intermediate group approaching *Helminthosporium dematioideum* in the size and shape of the conidia and conidiophores and in the occasional occurrence of solitary conidia. The production of catenate spores, on the other hand, would appear to connect this group with *Cladosporium*.

The third group, represented by *Heterosporium phlei*, *H. robiniae*, and *H. variabile*, resembles *Cladosporium* more than any other genus of black moulds. *H. variabile* may become so modified as to be taken for a typical *Cladosporium*. *H. phlei* is possibly a pathogenic race of some other species recorded on Gramineae. These three species are so nearly indistinguishable that complete dependence on spore characters is necessary for their recognition.

In the course of the present study the ascigerous stage of *H. ornithogali* was discovered in monoconidial cultures on both potato dextrose agar and sterilized leaves of *Ornithogalum umbellatum*. It is named *D. ornithogali* n. sp.

Bitancourt (A. A.) & Jenkins (Anna E.). **New discoveries of Myriangiales in the Americas.**—*Proc. eighth Amer. sci. Congr.*, Biol. Sci., Bot., pp. 151–172, 10 pl., 1940 (issued 1942).

Full descriptions and technical diagnoses are given of five new species of *Elsinoe*, and five of *Sphaceloma* [*R.A.M.*, xxi, p. 428], collected in Brazil and other States of Latin America, Florida (three), Dutch Guiana (one), and Puerto Rico (one). *S. spondiadis* produces a scab on the leaflets, midrib, and small stems of *Spondias purpurea* in Florida and a severe spotting of the fruit of *S. dulcis* in the Federal

District, Brazil. It is characterized by yellow to light brown, pseudoparenchymatous sporodochial masses, 30 to 150 μ in diameter, up to 60 μ in thickness, and a semi-continuous stroma, dark brown on the surface, paler below, up to 100 μ in diameter and 30 μ in thickness; crowded, subulate conidiophores were sometimes detected, but no conidia. *E. annonae*, the agent of anthracnose of *Annona cherimolia*, *A. squamosa*, and other *A.* spp. in São Paulo, Brazil, and believed to be also present in Venezuela, may be identified by its globose to piriform asci, 20 μ in diameter, containing up to eight hyaline, triseptate, usually straight spores, 12 to 15 by 5 to 8 μ; acervuli 40 μ in diameter, 20 μ in thickness, covering the old lesions with a deep greyish-olive layer; and a dense palisade of conidiophores arising from a thin basal stroma, conidia not having been observed. *Sphaceloma punicae* (*Hadrotrichum populi* Montem. non Sacc.) [ibid., xii, p. 661] causes a foliar anthracnose of pomegranate in Corrientes, Argentine, and São Paulo, and a fruit spot of the same host in the Pavia district of Italy, where the fungus was identified by Montemartini as *H. populi*. The hyaline to pale yellowish stroma, 15 to 40 μ in thickness, gives rise to a dense palisade of closely appressed conidiophores, 10 to 15 by 3 to 5 μ; conidia did not develop, but microconidia were abundant on the surface of the acervuli.

NEGRONI (P.) & FISCHER (IDA). **A propósito de Tritirachium Limber, 1940, nuevo género de Moniliaceae.** [A propos of *Tritirachium* Limber, 1940, a new genus of the Moniliaceae.]—*Rev. Inst. bact., B. Aires*, xi, 2, pp. 259–262, 2 figs., 1 diag., 1942. [French and English summaries.]

In view of the morphological affinities between Limber's genus *Tritirachium* (*Mycologia*, xxxii, pp. 23–30, 1940) and *Beauveria*, the authors recommend a comparative study of the species of the two genera.

SEELER (E. V.). **I. Two tree diseases caused by a species of Thyronectria. II. A monographic study of the genus Thyronectria.**—*Summ. Theses Ph. D. Harv., 1940*, pp. 79–82, 1942.

The first part of the author's thesis has already been noticed from another source [*R.A.M.*, xix, p. 734]. In connexion with his monograph on *Thyronectria*, all species of the Nectriaceae with muriform ascospores were examined and the ordinary criteria for generic separation of spore colour and extent of stromatic development found to be unreliable for application within this group. The following genera founded on these unstable characters have been reduced to synonymy: *Pleonectria* Sacc., *Chilonectria* Sacc. (in part), *Megalonectria* Speg., *Mattirolia* Berl. & Bres., and *Thyronectroidea* Seaver.

From a study of all the available material 16 species have been recognized, one of which is described for the first time as *Thyronectria lonicerae* on *Lonicera* and *Symphoricarpos* from Colorado and North Dakota, while the remainder are furnished with amended diagnoses, nine as new combinations. An analytical key, hitherto lacking, has also been compiled for the determination of these species. The conidial stages of *T. austro-americana* [loc. cit.] and *T. missouriensis* are described, the latter for the first time, and referred to *Gyrostroma* Naoumoff as *G. austro-americana* and *G. missouriensis*, respectively, Wollenweber's scheme [ibid., v, p. 700] being followed whenever practicable.

VOORHEES (R. K.). **Life history and taxonomy of the fungus Physalospora rhodina.**—*Bull. Fla agric. exp. Sta.* 371, 91, pp., 16 figs., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 6, p. 808, 1942.]

From a study of the different forms of *Diplodia* and related genera on tropical and subtropical hosts the author was convinced that only a few specific fungi were being dealt with and that many names of pathogens belonging to this group could

be reduced to synonymy. In the present investigations about 100 monospore isolates of *Physalospora rhodina* [*R.A.M.*, x, p. 96; xvii, p. 670] from various tropical and subtropical hosts in the southern United States and elsewhere were studied in detail and it became evident that an indefinite number of races were involved, very similar in appearance but differing in one or more characters. Many of the races were observed to arise in the sexual stage in nature. Nearly all were mutually differentiated by aversion reactions in culture, and frequently also by their growth rate and type, pigmentation, and perithecial characters. The sex factor or factors were shown to be carried by the ascospores in different ratios in the ascus. Slight differences in pathogenicity were detected between the individual races in certain cases, but no definite evidence of host specialization was forthcoming. The morphological variations among the conidial collections of *P. rhodina* examined are not considered sufficiently wide to merit specific distinction. At least three species of *Physalospora* exist which are not differentiable by their *Diplodia* stages, so that the sexual stages of many of the imperfect forms included under *P. rhodina* may, as indicated above, fall in undescribed species of *Physalospora* or related genera. The paper is furnished with a bibliography of 86 titles.

SUBBA RAO (M. K.). **The deterioration of Grevilleas on South Indian Tea plantations.**—*Pap. Tea sci. Sect. unit. Plant. Ass. sth. India* 3, 12 pp., 1942.

Much of the information contained in this summary of the observations on the deterioration of *Grevillea* [*robusta*] in southern India has already been published in the annual reports of the United Planters' Association [*R.A.M.*, xxi, p. 48]. In the present contribution the predominating responsibility of meteorological factors (notably wind and prolonged rain followed by severe drought), impoverished soil fertility, root competition, and ageing for the unthrifty condition of the trees is confirmed, the part played in its development by fungi (*Phyllosticta* sp. and *Cercospora* sp.) being purely secondary. Control measures aimed at the maintenance of this valuable and relatively hardy shade tree in a vigorous state of health are indicated. They include an age limit for standing trees of 25 years, selection of seed from the better-grown individuals in areas of poor development, and pollarding in wind-swept regions.

CLAYTON (E. E.) & SMITH (T. E.). **Resistance of Tobacco to bacterial wilt (Bacterium solanacearum).**—*J. agric. Res.*, lxv, 12, pp. 547–554, 3 figs., 1942.

In field and greenhouse trials conducted from 1934 to 1941 in North Carolina, none of the wild species of *Nicotiana* tested showed any resistance to bacterial wilt, *Bacterium solanacearum* [*R.A.M.*, xxi, p. 227]. Of the 1,034 collections of *N. tabacum*, chiefly from Mexico and Central and South America, Davis Special and a considerable number of foreign collections showed slight and T.I.79A and Turkish Xanthi moderate resistance. The only highly resistant tobacco was T.I.448A from Colombia, which was also highly resistant to common tobacco mosaic. This strain suffered less than 10 per cent. mortality under disease conditions which induced 100 per cent. mortality in susceptible types. A highly wilt-resistant genotype, 79–X, was obtained by crossing the above-mentioned moderately resistant types, T.I.79A and Turkish Xanthi, but it produced a very poor quality tobacco.

VALLEAU (W. D.). **Control of the common mosaic disease of Tobacco by breeding.**—*Phytopathology*, xxxii, 11, pp. 1022–1025, 1942.

Three promising lines are being pursued in connexion with the writer's endeavours to develop commercially desirable, mosaic-resistant varieties of Burley and dark tobacco at the Kentucky Agricultural Experiment Station, viz. (1) the hybridization of suitable varieties with *Nicotiana digluta* and repeated back-crossing; (2) the same processes, substituting Ambalema for *N. digluta* [*R.A.M.*,

xvii, p. 417]; and (3) repeated back-crossing of the best Ambalema type resistant plants (A) on similar plants having the *glutinosa* type of resistance (N) with a view to combining the two types of resistance. Objections have recently been raised to the introduction of the N factor in the control of tobacco mosaic [ibid., xxi, p. 227], but these appear from the author's experience to be devoid of foundation. The theoretical considerations in favour of the N element are discussed and supported by experimental data: for instance, of 441 plants containing this factor, 435 developed necrotic lesions on inoculation in the field in June, 1941, otherwise remaining healthy (Nn or NN), only six contracting systemic necrosis.

As regards the A type of resistance, the risk of systemic infection under farm conditions is negligible, but there is a real danger of the systemic development in N plants of a mottling strain of the virus as reported by Blood and Watson in connexion with *Datura meteloides* (*Proc. Utah Acad. Sci.*, xv, pp. 15–19, 1938). The combination in one variety of the two types of resistance will overcome both these hypothetical difficulties. When ten strains (294 plants) of Burley, heterozygous for N and back-crossed with A type resistant plants, were inoculated with the virus in the field, 245 showed no external signs of infection, 46 developed systemic mottling, and three showed a few chlorotic ring patterns on the lower leaves.

It would thus appear safe to conclude that both the A and N types of resistance, singly or in combination, will give satisfactory practical control of tobacco mosaic if incorporated in a homozygous condition in desirable commercial varieties.

DOOLITTLE (S. P.) & BEECHER (F. S.). **A strain of Tobacco-mosaic virus causing a necrosis and shriveling of Tomato foliage.**—*Phytopathology*, xxxii, 11, pp. 986–994, 2 figs., 1942.

During the past six years, greenhouse tomatoes at Beltsville, Maryland, have occasionally suffered from a mosaic disease causing foliar shrivelling and necrosis, which had already been observed in 1930 on plants grown under glass at Washington, D.C., and Arlington, Virginia. The disorder, which has only once been noticed in the field, is responsible for considerably more damage to tomatoes than the ordinary or yellow strains of tobacco mosaic (*Marmor tabaci* vars. *vulgare* and *aucuba*, respectively). The symptoms include the development on the older leaves, 12 to 15 days after inoculation, of small, diffuse, yellow areas, to which a characteristic russet-orange tinge is imparted by a minute, reddish-brown, necrotic stippling; the rusty patches gradually merge into large, light brown, papery spots, generally extending to the margins of the leaflets, inducing downward curling, torsion, and some degree of malformation. In plants 12 to 18 in. in height at the time of inoculation subjected to abnormally low temperatures (65° to 70° F.) for three or four days preceding the appearance of the symptoms, the entire leaflet may rapidly turn yellow, the small veins showing fine, necrotic markings. At an advanced stage of infection, the leaves wither from the base upwards, but remain attached to the plant, this feature of the mosaic being liable to confusion with injuries resulting from fumigation or chemical treatment. The disease progresses most rapidly at a temperature range between 60° and 75°. The virus is easily transmissible by the ordinary leaf-rubbing technique or by the alternate brushing, handling, and pruning of diseased and healthy plants.

The host range of the leaf-shrivelling virus, to which the name of *M. tabaci* var. *siccans* var. nov. is applied, appears to be identical with that of tobacco mosaic, and the former produces on Samsun tobacco, *Nicotiana rustica*, *N. paniculata*, *N. quadrivalvis*, and *N. glutinosa* the same symptoms as the latter. An aberrant feature of the new virus on *N. glauca* is the superficial, reddish-brown stippling, while on *N. sylvestris* dark brown, circular, necrotic primary lesions of the aucuba type are produced, systemic infection developing on the latter host at high summer

temperatures (90° to 95°) accompanied by veinal necrosis and the death of all the leaves except the youngest. The symptoms induced by *M. tabaci* var. *siccans* on chilli (*Capsicum frutescens*), *Physalis angulata*, *P. pubescens*, *P. heterophylla*, *P. alkekengi*, *Datura stramonium*, and Scotia bean (*Phaseolus vulgaris*) resemble those of tobacco mosaic.

In its physical properties and serological relationships the leaf-shrivelling virus also appears to be akin to that of tobacco mosaic, the thermal death point of both lying between 90° and 95° C., the dilution end point at 1 in 1,000,000 (consistent infection occurring on tobacco and *N. glutinosa* at 1 in 100,000), and their period of active persistence in dried foliage at room temperature up to seven years. On *N. sylvestris* previous infection by *M. tabaci* var. *siccans* protects the plants against the aucuba strain of the tobacco mosaic virus from tomato.

Seed transmission of the leaf-shrivelling virus has occurred in 5 out of 342 tomato seedlings grown from freshly extracted seed of diseased fruits, but not in those raised from seed subjected to more than ten days' drying. For the time being, the sources of primary infection remain in doubt.

THOMAS (W.) & MACK (W. B.). **A foliar diagnosis study of greenhouse Tomato plants showing symptoms of streak disease.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 319–328, 3 diags., 1941.

In greenhouse tests at the Pennsylvania Agricultural Experiment Station on differentially fertilized tomatoes with and without manure, the plants (Marglobe) on one plot given nitrogen (sodium nitrate) only without manure developed symptoms of streak ten weeks after planting. The method of foliar diagnosis [*R.A.M.*, xxi, p. 269] was applied and the results denoted that the streak symptoms were associated with a lower intensity of nutrition and a disequilibrium with regard to nitrogen, phosphoric acid, and potash manifested primarily by excessively high values for nitrogen in relation to potash in the nitrogen-phosphorus-potassium unit of diseased compared with healthy plants.

DAVIS (S. H.). **Poplar canker. On the susceptibility of various Poplar species.**—*Bull. Morris Arbor. Univ. Pa*, iv, 3, p. 28, 1942.

A survey of poplars in the nursery of the Morris Arboretum, Pennsylvania, showed the following varieties to be free from canker due to *Dothichiza* [*populea*: *R.A.M.*, xix, p. 68]: *Populus alba nivea*, *P. alba richardii*, *P. brevifolia*, *P. euphratica*, *P. generosa*, *P. maximowiczii*, *P. tomentosa*, *P. trichocarpa*, and *P. genera*.

CAMPBELL (W. A.) & SPAULDING (P.). **Stand improvement of northern hardwoods in relation to diseases in the Northeast.**—*Occ. Pap. Allegheny For. Exp. Sta.* 5, 25 pp., 9 figs., 1942. [Mimeographed.]

The most serious disorders in the hardwood forests of the north eastern United States are cankers caused by *Nectria* [*R.A.M.*, xx, p. 139], *Eutypella parasitica* on maples [ibid., xix, p. 243], *Hypoxylon blakei* on red and sugar maples (*Acer saccharum* and *A. rubrum*), and *H. pruinatum* on aspen (*Populus* spp., including *P. tremuloides*) [ibid., xix, p. 505], and various rots caused by a number of Polyporaceae. The latter group comprises (*a*) those with perennial conks on living trees, viz., *Fomes igniarius*, the agent of a white trunk rot affecting nearly all hardwoods except oak; *F. applanatus* [*Ganoderma applanatum*], causing a mottled white rot of many hardwoods, its sporophores being common, for instance, on street maples [*Acer* spp.], developing on wounds or near large dead branch stubs; *F. pinicola*, the brown cubical rot due to which chiefly affects conifers but is also common on vigorous black cherry (*Prunus serotina*) on the Allegheny Plateau, causing a severe top and trunk rot; *F. connatus*, the agent of a white, soft, watery

rot of sugar and red maples and other hardwoods [ibid., xix, p. 310]; *F. fraxinophilus* [ibid., xviii, p. 280], inducing a white to yellowish top and trunk rot of American ash (*Fraxinus americana*); *F. fomentarius* on birch and maple; and *Daedalea unicolor*, the white rot produced by which is mostly found on maple, though nearly all hardwoods are liable to infection; (*b*) those forming sterile 'conks' or cankers on living trees and sporophores on the same hosts after death, viz., *Poria obliqua*, which causes a white rot of birches indistinguishable from that caused by *F. igniarius*, and the sterile, black, clinker-like conks of which have been considered to belong to that species and *F. nigricans* [ibid., xix, p. 56], *Ostrya virginiana* being another host of the fungus; *Polyporus glomeratus*, the cause of an important soft, white or yellowish decay of *A. rubrum* and *A. saccharum* and beech trunks [ibid., xix, p. 125], the sterile conks on the maples sometimes protruding conspicuously, and on beeches somewhat resembling those of *Poria obliqua* on birches; and *F. igniarius* var. *laevigatus* [ibid., xx, p. 503], most frequently occurring on dead trees or logs of birch; and (*c*) those forming annual sporophores on living trees, viz., *Polyporus sulphureus*, chiefly on oak, though black cherry is also frequently attacked and birch, maple, and ash occasionally; *Hydnum septentrionale* and *H. erinaceus* [ibid., xix, p. 246] form fruiting bodies on living trees, the former being prevalent on *A. saccharatum* and the latter on oak, while both occur on beeches.

Armillaria mellea is the agent of a soft, white, watery root and butt rot of a number of hardwoods, and *Ustulina vulgaris* is found chiefly on *Acer* spp. and beech, inducing a characteristic white butt and trunk rot intersected by numerous irregular, black lines [ibid., xix, p. 624].

'Burls' or abnormal swellings of varying size and shape may be seen on nearly all hardwoods; some are believed to be of bacterial origin, while one on oak is known to be associated with a fungus. Fusiform 'burls', starting as localized swellings, and usually developing into cankerous areas, are prevalent on *A. saccharatum* throughout the region under observation. The greenish-black discoloration of the underlying sapwood may penetrate to the cambium. The same tree is liable to greenish stains resulting from various causes, e.g., chemical reaction and *Nectria* cankers, while a blackish discoloration of the central core of older trees is known as 'blackheart'. The value of *A. saccharatum* depending largely on the whiteness of the sapwood, such stains may assume considerable importance. The prevention of the trunk injuries through which the pathogenic agencies gain ingress appears to be the sole means of control. 'Red heart' of paper and yellow birches (*Torula ligniperda*) [ibid., xx, p. 326] may be responsible for substantial economic damage.

Among the recommendations made for stand improvement are the selection of rot-free, 15- to 25-year-old trees and the avoidance of wounds inflicted by careless felling, sun scorch, wind, insects, and the like. Most canker infections occur before the age of 25 years and canker-free trees selected at this age can be expected to remain healthy. Stand improvement is not usually justified on a heavily cankered site since succeeding hardwoods cannot be expected to do better. The main purpose of stand improvement being the production of an abundance of high-grade timber in the shortest possible time, any method adopted should aim at an increase in the percentage of sound trees of desirable species left to grow. Older stands already damaged by rot should be harvested as early as practicable. The amount of potential inoculum may be reduced by the felling of trees bearing 'conks' of heart-rotting fungi, which should preferably be utilized for firewood. It is unnecessary and even undesirable, however, to cut down all 'conk'-bearing trees, e.g., *A.* spp. and beech infected by *P. glomeratus* and birch by *Poria obliqua*, spore production on which takes place only after the death of the host. In such cases it is both safe and advisable to leave such trees to maintain the canopy. For the improvement of sprout stands 15 to 25 years old, it is recommended that the crop

trees should be selected from clumps of not more than four sprouts, that the most promising sprout should be retained and the others removed, that if an unwanted stem has a low connexion with the favoured one, it should be cut so as to leave a short stub, and that a sprout should not be considered a good risk if the removal of an unwanted stem causes a wound more than 3 in. in diameter.

Pomerleau (R.). **Liste annotée des maladies parasitaires des arbres observées dans le Québec.** [An annotated list of the parasitic diseases of trees observed in Quebec.] —Minist. Terres For. (Québec), Serv. for., 39 pp., 1942. [Mimeographed.]

In this annotated list of parasitic diseases of trees observed by the author in Quebec during the past 20 years and mentioned by other workers, the trees are arranged in the alphabetical order of their French names, conifers preceding deciduous trees; English and Latin names are also given. The popular name of each disease appears in French and English, followed by the name of the pathogen, intermediate host (if any) in Latin, the importance and geographical distribution of the disease also being noted.

The work is intended to be only of a provisional nature, and to be followed by a further edition, with corrections and additions, in a more permanent form.

Graves (A. H.). **Breeding work toward the development of a timber type of blight-resistant Chestnut: report for 1941.**—*Amer. J. Bot.*, xxix, 8, pp. 622–626, 3 figs., 1942.

This progress report on chestnut breeding for resistance to blight (*Endothia parasitica*) [*R.A.M.*, xxi, p. 173] records the results of breeding various chestnut species and hybrids during 1941. It is stated that the possibility of natural variation in resistance to the disease should not be overlooked, and a plea is made for native nuts to be sent to the Brooklyn Botanic Garden.

Ehrlich (J.). **Occurrence of Gonatorrhodiella highlei in Nova Scotia and New Brunswick.**—*Mycologia*, xxxiv, 6, p. 705, 1942.

The author records the occurrence of *Gonatorrhodiella highlei* in association with *Nectria coccinea* and the woolly beech scale (*Cryptococcus fagi*) [*R.A.M.*, xvi, p. 645] on diseased beech stands throughout Nova Scotia and in Albert County, New Brunswick, during the summers of 1930, 1931, and 1932.

Braucher (O. L.) & Southwick (R. W.). **Correction of manganese-deficiency symptoms of Walnut trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 133–136, 2 figs., 1941.

Satisfactory control of manganese deficiency in English walnuts in Ventura County, California, the symptoms of which include interveinal mottling, followed by bronzing and sometimes by scorching, has been obtained by (*a*) the injection into holes 2 to 4 in. in depth and ⅜ in. in diameter of dry manganese sulphate at the rate of 5 gm. per hole and four holes per limb of 4 to 6 in. in diameter, the treatment being applied during the summer or winter; and (*b*) spraying in May and June with solutions of the same compound at concentrations of 5, 10, or 15 lb. per 100 gals.; stronger doses (20 or 25 lb.) are apt to induce severe leaf burn.

Loustalot (A. J.) & Hamilton (J.). **Effects of downy spot on photosynthesis and transpiration of Pecan leaves in the fall.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 80–84, 1 graph, 1941.

The results of experiments at the United States Pecan Field Station, Brownwood, Texas, in the autumn of 1940 afforded unmistakable evidence of a marked reduction in the photosynthesis of the leaves of a nine-year-old Western pecan tree attacked by downy spot (*Mycosphaerella caryigena*) [*R.A.M.*, xi, p. 552], the differences

between normal and diseased leaflets in this respect being more pronounced during the morning than later in the day. The average morning assimilation rates of the healthy and infected leaflets were 4·59 and 3·13 mg. carbon dioxide per 100 sq.cm. per hour, the corresponding figures for the afternoon being 3·38 and 2·63 mg., respectively. The average morning transpiration rates of the normal and spotted leaflets were 0·55 gm. per 100 sq.cm. water and 0.47 mg., respectively, the corresponding afternoon figures being 0·48 and 0·46 mg., respectively. In the morning, high assimilation rates generally corresponded with high transpiration rates whereas in the afternoon the relationship between the two processes was usually reversed.

MARTÍNEZ (J. B.). **Las micosis del Pinus insignis en Guipúzcoa.**—[The mycoses of *Pinus insignis* in Guipúzcoa.]—[*Publ.*] *Inst. for. Invest. Exp., Madr.*, xiii, 23, 72 pp., 13 pl. (1 col.), 2 diags., 1942. [French, English, and German summaries.]

Pinus radiata (*P. insignis*) in the province of Guipúzcoa, northern Spain, is affected by a number of fungal diseases some of which are destructive and may involve entire stands. The damage is sufficiently severe to hamper the acclimatization of the tree in parts of the country. The pathogens inducing defoliation include *Naemacyclus niveus* [*R.A.M.*, xii, p. 254], *Septoria* [or *Systremma*] *acicola* [ibid., xi, p. 813; xx, p. 186], believed to be recorded for the first time from Europe and certainly new to the Iberian Peninsula and the Balearic Islands, *Diplodia acicola* (also new to Spain and Portugal), and *Lophododermium pinastri* [ibid., xii, p. 604 *et passim*]. Of the two wood-rotting species occurring on *P. radiata*, *Dacryomyces palmatus* (new to the Iberian Peninsula) causes an intensive decay, resulting in the desiccation and disorganization of the wood, whereas the yellow to ochraceous rot with white patches due to *Irpex fuscoviolaceus* is of no economic importance.

The studies were extended to some neighbouring stands of *P. sylvestris* and *P. nigra* with a view to determining the role of these trees in the transmission of *L. pinastri* to *P. radiata*. The fungus in question, however, was found to be absent from *P. sylvestris* and of secondary importance on *P. nigra*, the predominant species on both of which was *Diplodia acicola*. *S. acicola* is so far confined to *P. radiata*, which appears to be a new host for the fungus. *N. niveus* is the predominant pathogen of *P. radiata*, followed by *L. pinastri*, the former having also been observed on *P. pinaster* on Mount Jaizquibel; both hosts of *N. niveus* are new for the Iberian Peninsula, the only one previously recorded for Spain being *P. montana*.

The symptoms induced by the several pathogens are briefly described and the morphology and taxonomy of the latter critically discussed. Little is known regarding the pathogenicity of *N. niveus*, which appears to assume two phases, one chronic and the other acute; in the former case the fungus is frequently observed on fallen needles of *P. pinaster* in association with *L. pinastri*, while in the latter, prevalent on *P. radiata*, fruit bodies of *N. niveus* develop on needles still attached to the tree. The available information regarding *D. acicola* is also scanty, and the author's inoculation experiments on *P. radiata* with spore suspensions of the fungus have given inconclusive results. His observations at the central nursery of Amaza-Mendi, however, have convinced him of its pathogenicity, intensive infection having been present on the needles of the distorted terminal buds of shrivelled plants.

Dealing with control measures, the author advocates as the first step the procurement of seed from healthy trees and its examination on a dextrose agar medium for superficial and internal fungal contamination before planting. Nursery precautions should include the choice of sites on non-clay soils, remote from infected stands and, where practicable, surrounded by hardwoods or at any rate by a hedge of *Cupressus macrocarpa* or oak (*Quercus rubra*), 15 to 20 in. in thickness; thorough

preparation of the soil and the application of fertilizers, sparse sowing, eradication of weeds from the beds, and the rejection of sickly and ill-developed plants at transplanting. Localities known to be favourable for the disease should be avoided.

In an appendix (pp. 61–67) are summarized the principal legislative regulations promulgated in various countries for the avoidance of the introduction and spread of certain well-known and dangerous fungal diseases of trees.

Lohman (M. L.), Cash (Edith K.), & Davidson (R. W.). **An undescribed Atropellis on cankered Pinus virginiana.**—*J. Wash. Acad. Sci.*, xxxii, 10, pp. 296–298, 1 fig., 1942.

A hitherto undescribed species of *Atropellis* was found, for the first time in 1933 and on several occasions since, on scrub pine, *Pinus virginiana*, in Virginia and North Carolina, in association with a canker similar to those caused by *A. tingens* and *A. piniphila* [*R.A.M.*, xix, p. 629]. Cultures obtained from ascospores showed a general similarity to those of *A. pinicola* Zell. & Goodd. and *A. tingens*. On malt agar the mycelial mats were erumpent, black, and uneven, of slow growth, with areas of fine, grey tomentum. An 'old gold' to 'Hessian brown' colour was induced by placing particles of a three-months-old mycelium in dilute caustic potash solution. The new species, which is named *A. apiculata*, was found to agree with the other four canker-forming species of its genus, i.e., *A. arizonica*, *A. pinicola*, *A. tingens*, and *A. piniphila*, in all features of generic importance. It has some characteristics in common with each of these four, but is distinct from all of them in the somewhat lighter-coloured hymenium as seen in expanded apothecia, in the sharply pointed to apiculate ascospores (which are hyaline, continuous at first but finally uni- or rarely biseptate, 20 to 24 by 4·8 to 6·5 μ including the apiculae 2 to 3 μ long), in the brownish epithecium largely responsible for the rich brown colour given by the caustic potash test, and finally in the apparent lack of a conidial stage. No inoculations were made, but it is assumed that the fungus is pathogenic because of its constant association with cankers and discoloured wood.

König (E.). **Pilzschäden am Holz, Polyporus borealis Fr. (Nördlicher Porling).** [Fungal damage on wood, *Polyporus borealis* Fr. (northern pore fungus).]—*Holz Zbl.*, lxviii, 37, pp. 257–258, 1942. [Abs. in *Holz Roh-u. Werkstoff*, v, 9, p. 328, 1942.]

Polyporus borealis, which normally occurs as a saprophyte on spruces, may assume a parasitic form wherever injuries afford ingress to the stem wood. The initial brown discoloration of the invaded tissues is succeeded by a white rot, primarily involving the spring layers of the heartwood, which eventually crumbles into cubical fragments. The life-history and fruit bodies of the fungus are described.

Baxter (D. V.) & Varner (R. W.). **Importance of fungi and defects in handling Alaskan airplane Spruce.**—*Circ. Mich. Sch. For.* 6, 35 pp., 8 pl., 1942.

This preliminary report on the incidence and importance of *Trametes serialis* and other fungi on Alaskan Sitka spruce (*Picea sitchensis*), studies on which are now in progress at the Michigan School of Forestry, is issued in recognition of the immediate need for information regarding the vital problem of the protection of a major source of aeroplane timber [*R.A.M.*, xxi, p. 397]. Besides the well-known *Fomes pini*, *Polyporus schweinitzii*, and *P. sulphureus*, a number of other fungi are responsible for various forms of more or less severe damage, including *P. anceps*, *P. albo-luteus*, *Poria subacida*, *P. crustulina*, *Polystictus abietinus*, *T. alaskana*, *T. heteromorpha*, and *T. variiformis*. A key is given showing the cultural features of the various species under investigation, which are further classified in a table in three groups according to their growth rates at 25°, 30°, and 35° C. Recommendations for the avoidance of fungal damage comprise stringent mill and dock sanitation, including the treatment of floorings, &c., with a disinfectant,

such as one part each of sodium fluoride and sodium arsenite to 98 parts of water, kiln-drying at 145° F. (for material up to 3 in. in thickness, lowering the temperature by 5° for each in. increase), and the preservative treatment of the individual wood pieces after manufacture and before assembly of the planes. Packing cases for plane parts should be made of sound wood, and as crates may become wet in transit parts should not be kept in them any longer than necessary. Treatment with water-repellent chemicals may be useful for parts subjected to long storage. Fungous defects are much more difficult to eradicate than structural defects of the wood, e.g., spiral grain, and new infections may occur during manufacture, shipment, or even in the plane itself. Constant vigilance is required in eliminating infected wood at all stages of handling.

HEMMI (T.), AKAI (S.), & OHNO (H.). **A study on the relative resistance of the Beech wood to decay.**—*Ann. phytopath. Soc. Japan*, x, 4, pp. 304–316, 4 figs., 1941.

In the writers' experiments under controlled conditions on the relative resistance of beech (*Fagus crenata*) wood to 16 wood-destroying fungi, Hubert's designations of 'decay durability' and 'decay resistance' for the length of service of wood and its relative resistance to decay, respectively [*R.A.M.*, ix, p. 149], were adopted. The test blocks of wood were inserted into flasks containing agar cultures of *Polystictus hirsutus*, *P. sanguineus*, *Polyporus rhodophaeus*, *P. orientalis* [ibid., xviii, p. 4], *P. patouillardii*, *P. mikadoi* [ibid., xiii, p. 279], *P. schweinitzii*, *P. betulinus*, *P. sulphureus*, *Ganoderma applanatum*, *G. lucidum*, *Irpex consors*, *Stereum frustulosum*, *S. induratum*, *Fomes pinicola*, and *Trametes dickinsii* [ibid., xvii, p. 785], and maintained therein for 320 days at 24° C. The mycelia of *P. mikadoi*, *P. orientalis*, *P. patouillardii*, *G. applanatum*, and *G. lucidum* formed distinct zone lines at their points of contact with the glass walls of the flasks.

The most severe decay was caused by *P. mikadoi*, while the least effect on the wood was exerted by *S. frustulosum*, the losses in the average dry weight of the blocks exposed to these two fungi being 60·92 and 11·15 per cent., respectively. The extent of the loss in dry weight in the test blocks was not correlated with the luxuriance of mycelial growth on them. Apart from *P. mikadoi*, the agents of white pocket rot were usually characterized by sparse mycelial growth and induced slight loss in weight of beech wood; they caused the formation of pockets deep in the wood. In the case of *Polystictus hirsutus* and *P. sanguineus*, the optimum temperatures for the mycelial development of which substantially exceed that obtaining in the experiments under discussion, there was extensive rotting of the surface of the blocks, accompanied by fairly high losses of weight, but the central tissues of the wood remained in an almost sound condition. *Polyporus orientalis* and *P. schweinitzii*, which normally occur on pines and other conifers in Japan, induced the formation of white pockets and a brown cubical rot, respectively, in the beech test blocks.

FINDLAY (W. P. K.). **Resistance to decay.**—*Emp. For. J.*, xxi, 2, p. 134, 1942.

In standard laboratory tests carried out at the Forest Products Research Laboratory, Princes Risborough, wood of akomu (*Pycnanthus kombo*) from West Africa showed, after four months' exposure, some resistance to fungi causing brown rots (*Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Poria vaillantii*, and *Lenzites trabea*), whereas it was readily and severely attacked by those causing white rots (*Polystictus versicolor* and *P. sanguineus*). It is concluded that akomu is not suitable for use in any exposed situation where it might be exposed to damp conditions. Wood of 'peroba rosa' (*Aspidosperma polyneuron*) from Brazil exhibited a high degree of resistance to all the test fungi. No evidence was obtained that the variations in colour which occur in the heartwood of this species are related to variations in resistance to decay.

FINDLAY (W. P. K.). **Resistance to decay of Pinus strobus.**—*Emp. For. J.*, xxi, 2, p. 134, 1942.

In comparative tests [see preceding abstract] of resistance to fungal decay in *Pinus strobus* and *P. sylvestris* timbers, the average loss in weight caused by the five test fungi was 15·8 per cent. for the former and 14·0 per cent. for the latter species. It is concluded that the durability of *P. strobus* is unlikely to be any greater than that of *P. sylvestris*, and that the timber should be classified as only 'moderately resistant' to fungal decay.

CARTWRIGHT (K. St. G.). **The variability in resistance to decay of the heartwood of home-grown European Larch, Larix decidua, Mill. (L. europaea) and its relation to position in the log.**—*Forestry*, xvi, pp. 49–51, 1942.

In experiments at the Forest Products Research Laboratory [cf. *R.A.M.*, xxi, p. 311] on larch wood, which is not known to contain an extractive toxic to fungi, discs of heartwood cut from the clear bole of a 95-year-old tree at the butt, and at heights of 20 and of 40 ft., and either adjacent to the sapwood or to the pith, were exposed to sawdust cultures of *Polyporus schweinitzii* for four months, *Poria xantha* for two, and *Fomes annosus* for eight. The results showed that samples taken adjacent to the sapwood were generally more resistant (in terms of loss of oven-dry weight) than those adjacent to the pith; the only exception occurred in the case of *P. xantha* on the 20 ft. samples, where the results were exactly reversed. No explanation was found for this reversal. There was no evidence of any significant progressive variation in degree of resistance in samples according to the height from which they had been taken, except that those taken from the base were on the whole the most durable. There was indication of a progressive increase in resistance from the centre of the trunk outwards towards the sapwood, suggesting that the variation in resistance may be associated with variations in the concentration of extractive. The results of this study lend support to suggestions previously offered [loc. cit.] that heart rots in living trees might be due not only to infection through dead tap-roots, but also to the fact that the central core may in many species be more susceptible to fungal attack owing to absence of sufficiently high concentrations of extractives which contain substances toxic to fungi.

HARDY (E.). **Preserving pit props.**—*Colliery Engng*, xix, 216, pp. 63, 65, 1942.

The increasing cost and shortage of timber necessitate the utmost precautions on the part of colliery managers to preserve their pit props in order to reduce replacements to a minimum, and some practical recommendations are made for the application of creosote and other standard disinfectants. A very high degree of preservation, extending the life of the props three or four times, may be attained by standing them in a tank of creosote heated to 180° to 200° F. on a brick furnace for an hour or two, then letting the fire die out and leaving the props over-night. The best results are probably secured by the use of a brand of creosote containing a minimum of 40 per cent. of naphthalene fractions. Tar-oil distillates, 2 per cent. triolith (Wolman salts), 2 per cent. sodium fluoride, and a number of poisonous chemical compounds, the risks attendant on the use of which are likely to prevent their large-scale use, have also given satisfactory preservation.

Considerable misunderstanding appears to prevail with regard to the moisture-absorbing properties of timber. For instance, Douglas fir [*Pseudotsuga taxifolia*] with a 27 per cent. moisture content creosoted by pressure on arrival in England can still absorb about 33 per cent. more water than comparable samples subjected to nine months' seasoning before preservation, thereby reducing the moisture content to 20 per cent. With this species, penetration of creosote is irregular except by incisions, and end is preferable to side penetration. Scots pine [*Pinus sylvestris*]

seasons well and easily, and may be kiln-dried to 10 per cent. moisture content from the green in ten days at 200°. Reasonably good penetration of the heartwood with creosote may be secured by the open-tank or pressure process. Scots pine is second only to larch [cf. *R.A.M.*, xxi, p. 315] in natural durability, the latter being the most resistant to dry rot [*Merulius lacrymans*] of all British timbers used for pit props. It is, however, also very resistant to penetration with preservatives even under pressure, and requires rapid but careful kiln-drying to avoid splitting. Peeled timber is much more resistant to dry rot than that with the bark left on.

The spores of *M. lacrymans* frequently gain access to the wood before it enters the mine, and the timber should therefore be stacked on damp-proof foundations, e.g., old railway sleepers, bricks, clinkers, or cinders, with a ventilation space of 1 ft. between the piles, and not on the bare ground.

HERRICK (J. A.) & ALEXOPOULOS (C. J.). **A further note on the nitrogen metabolism of Stereum gausapatum Fries.**—*Ohio J. Sci.*, xlii, 3, pp. 109–111, 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 6, pp. 808–809, 1942.]

The growth of *Stereum gausapatum* [*R.A.M.*, xviii, p. 718] on media containing peptone, asparagin, or ammonium ions as the sole source of nitrogen was greatly increased by the addition of minute amounts of thiamin. In the case of ammonium nitrate, the development of the fungus was roughly proportional to the thiamin content of the substratum. Even in the presence of thiamin, growth on media containing only nitrate ions as nitrogen sources was negligible, failure to develop under such conditions not being attributable to toxicity.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **Development of Penicillium on the cut surfaces of certain vegetables.**—*Nature, Lond.*, cli, 3819, pp. 54–55, 1943.

When the cut surfaces of potato, sugar beet, turnip, Jerusalem artichoke [*Helianthus tuberosus*], carrot, and onion were dipped momentarily in a $2\frac{1}{2}$ per cent. solution of copper sulphate, *Penicillium* sp. developed within five days if the surfaces were kept under moist conditions, though similar, untreated surfaces remained unaffected. A similar effect resulted when solutions or suspensions of other copper salts were tested, viz., the acetate, chloride, nitrate, carbonate, chromate, formate, and salicylate, also copper potassium sulphate and copper ammonium sulphate. When copper sulphate was used with potato, tissue discoloration preceded fungal growth. With concentrations of copper sulphate under 1 per cent. *Penicillium* sp. had not developed after seven days, though discoloration resulted at concentrations as low as 1 in 400. The nitrates of barium, bismuth, calcium, cobalt, iron, lead, magnesium, mercury, nickel, potassium, silver, sodium, strontium, and zinc were also tested, but a marked and early growth of *Penicillium* sp. occurred only when the surfaces were treated with the cobalt salt, though a smaller amount of growth developed later with nickel and iron, and very slight growth with mercury.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 11, pp. 504–510, 13 figs., 1942.

Notes are given on the principal diseases of cabbages, cauliflowers, and turnips in New South Wales and on their control by hot-water seed treatment, suitable care in the seed-bed (including spraying with Bordeaux mixture), choice of land, and crop rotation. Magnesium deficiency generally responds to an application of dolomitic lime at the rate of 2 tons per acre, made preferably a year before planting. In sandy coastal soils, symptoms of potassium deficiency take the form of a yellowing of the leaves between the veins and especially around the margins of the outer leaves where the tissue eventually dies.

PERSON (L. H.) & CHILTON (S. J. P.). **Seed and soil treatment for the control of damping-off.**—*Bull. La agric. Exp. Sta.* 349, 16 pp., 1942. [Abs. in *Exp. Sta. Rec.*, lxxxvii, 6, p. 810, 1942.]

During a seven-year series of trials in the Sharkey and Olivier soils of Louisiana, seed treatment with red copper oxide proved to be the most practical and effective method of combating damping-off [miscellaneous fungi, including *Pythium de Baryanum* and *Corticium solani*] of tomatoes and bell peppers [*Capsicum annuum* var. *grossum*], but it was toxic to cabbage, which responded most satisfactorily to seed disinfection with vasco 4 [*R.A.M.*, xvii, p. 365] or zinc oxide. Soil treatments with commercial formaldehyde were about equally effective with red copper oxide for the control of damping-off in tomatoes and peppers, but were of little use against the disease in eggplants, post-emergence symptoms on which were further not prevented by seed disinfection with red copper oxide, but yielded to the superficial application of zinc oxide, vasco 4, or yellow copper oxide to the soil. Formalin, diluted in five or six times its volume of water, eliminated infection in tomatoes, peppers, and eggplants, but was injurious to the last-named on Olivier soil. Yellow copper oxide was the most efficient of the fungicides tested against damping-off in ornamentals, followed by red copper oxide, vasco 4, and zinc oxide in the order given. Organic mercury dusts, applied at full strength, often caused damage to the plants.

WAIN (R. L.) & WILKINSON (E. H.). **A new copper seed protectant.**—*Gdnrs' Chron.*, Ser. 3, cxiii, 2925, p. 27, 1 fig. (on p. 26), 1943.

In this preliminary note on studies at Long Ashton on the treatment of early-sown peas against damping-off with copper sebacate (the copper content of which is only 24 per cent.), it is stated that trials were made with selected copper compounds, including a proprietary red cuprous oxide (89 per cent. copper) and copper sebacate, on Surprise, Eclipse, and Foremost peas in sterile and non-sterile soil, grown in boxes in an unheated greenhouse.

At equivalent copper concentrations, dilution where necessary being made by the addition of talc, copper sebacate gave higher percentage emergence (82·5, 82·5, and 96·0 for the three varieties, respectively), than cuprous oxide (63·0, 79·0, and 83·0) in non-sterile soil (the untreated controls giving 16·5, 25·5, and 71·5). The degree of copper damage as indicated by percentage emergence in sterile soil showed no significant difference between copper sebacate and cuprous oxide.

At equivalent weights of compound, the two materials gave equally good control of damping-off, in spite of the lower copper content of the sebacate, and of its lower average adherence (60 per cent., as against 94 per cent. for the cuprous oxide). In neither case was any copper damage noted. Further experiments are planned which, if successful, will permit an even greater reduction in the amount of copper used.

DAVIES (D. L. G.). **A Fusarium wilt of Runner Beans.**—*Trans. Brit. mycol. Soc.*, xxv, 4, pp. 418–426, 1 pl., 1 fig., 1 graph, 1942.

The wilt disease of runner beans (*Phaseolus multiflorus*) [*P. coccineus*] reported by Ogilvie and Mulligan [*R.A.M.*, xiii, p. 668], is stated to occur mainly in the Severn valley near Kempsey, and also at Pershore and Bretforton. The first symptoms may appear on the primary leaves, the margins of which become yellowish-green; later the whole leaves wither and droop, the margins rolling inwards; and finally, the entire plant wilts and dies. The disease causes a discoloration of the vascular system which sometimes seems to occur in tissue where no hyphae could be found, the fungus being confined to the xylem, though in severely infected plants it also invades the pith and cortical tissues. In experiments conducted from 1936 to 1938, the causal agent was isolated from diseased parts, and monospore cultures of the

fungus were identified by Wollenweber as *Fusarium vasinfectum* var. *lutulatum*. The fungus was tolerant of temperatures ranging from 2° [4° in the summary] to 34° C., but grew best at 28° [26°], which was also the optimum for spore germination. At this temperature the spores germinated after five hours, even after previous exposure to 15° of frost out of doors or to a moist heat of 40°. The pathogenicity of the fungus was proved by inoculating the bases (but not the stems) of plants and by sowing seed in infected soil, the results of these tests indicating that infection takes place primarily through wounds caused by soil pests. Waterlogging of the soil had no appreciable effect upon the severity of the disease. In cross-inoculation tests, conducted in the greenhouse and the field, dwarf beans (*P. vulgaris*), broad beans (*Vicia faba*), sweet peas (*Lathyrus odoratus*), and garden peas developed no symptoms. Of the varieties of runner beans tested in the field, Giant Painted Lady was outstanding in resistance to the disease, while good resistance was also shown in descending order, by Czar, Sutton's Scarlet, Giantess Painted Lady, and White Prize-Winner.

KENDRICK (J. B.) & SNYDER (W. C.). **Fusarium yellows of Beans.**—*Phytopathology*, xxxii, 11, pp. 1010–1014, 1942.

The vascular *Fusarium* disease of field beans (*Phaseolus vulgaris*) observed in the Sacramento Valley of California in 1929 and 1933 [*R.A.M.*, xiv, p. 207] did not reappear until 1940, when it was detected in two large plantings of pink beans, in one of which, covering 50 acres, the damage was estimated at 50 per cent., while the other contained only isolated infected plants. The symptoms of the disease include a gradual yellowing of the foliage from the base upwards, ultimate shedding of the leaves, stunting of the plants, frequently leading to their death, and a dark brown discoloration of the vascular system of the stem and leaf petioles.

The species of *Fusarium* consistently isolated from the diseased bean tissues resembled the agent of cowpea wilt (*F. oxysporum* f. [*F. bulbigenum* var.] *tracheiphilum*) in pure culture on a mixture of oats and soil, both steam-sterilized. In soil-inoculation experiments with the former, positive results were obtained only on pink and Red Mexican beans (14·2 and 25·8 per cent. infection, respectively), Lima beans (*P. limensis* var. *limenanus*) [*P. lunatus*], cowpeas, and soy-beans remaining immune. In view of the evidence furnished by field, greenhouse, and cultural studies the bean-yellows organism is designated *F. oxysporum* f. *phaseoli* n.f. It is transmissible by way of the seed, but infection from this source may be combated by seed treatment with ceresan or semesan. It was experimentally demonstrated that Lima beans, cowpeas, and soy-beans may be planted in soil infested by the bean-yellows fungus without risk of contamination.

LACHANCE (R. O.), BERTRAND (P.), & PERRAULT (C.). **Manifestation extrême de la gerçure des pétioles du Céleri. Maladie par carence de bore.** [An extreme case of cracked stem of Celery. A boron deficiency disease.]—*Sci. Agric.*, xxiii, 3, pp. 187–193, 4 figs., 1 graph, 1942. [English summary.]

In 1939, celery growing in the market-garden area between Quebec and Deschambault was found to be affected by stem-cracking [*R.A.M.*, xvi, p. 792; xxi, p. 23], accompanied by dwarfing and heart atrophy. Affected plants ceased to grow towards the end of July, and brown stripes appeared on the outer petioles. The epidermis and the collenchymatous bundles split transversely, became raised at the extremities, and rolled up, forming cracks which became progressively more numerous. The petioles were rigid and brittle. The internal petioles grew very abnormally, bending over and mingling with one another, then turning brown and drying up. This process began at the extremities of the young leaflets and gradually spread to the base of the petioles, which disappeared as if reduced to powder. All that remained of the plant at the end of the season was a crown of external petioles,

the adaxial surface of which was brown and corky, surrounding a cavity. The brown bottom of this cavity was the stalk, properly so-called. This 'heart atrophy' differs from celery black-heart [ibid., xvii, p. 647] in that the former occurs only on dwarfed plants, and is always accompanied by stem crack.

The disease was prevented and normal growth obtained (on acid muck soils) by an application of 15 lb. of borax per acre [ibid., xxi, p. 442]. Soil liming appeared to favour the condition.

Pryor (D. E.). **The influence of vitamin B_1 on the development of Cantaloupe powdery mildew.**—*Phytopathology*, xxxii, 10, pp. 885–895, 1 fig., 1942.

Of the two cantaloupe selections used in the writer's studies at the United States Horticultural Field Station, La Jolla, California, on the influence of vitamin B_1 (thiamin hydrochloride solution) on the development of powdery mildew (*Erysiphe cichoracearum*), Powdery Mildew Resistant No. 45, highly resistant to race 1 [*R.A.M.*, xvii, p. 157], was attacked by race 2 [see next abstract] whereas strain 28949, completely resistant to race 1, responded to inoculation with race 2 by the production of necrotic spots, usually without macroscopically visible mycelium. The stock culture used in the tests was probably composed entirely of race 2. The addition of the growth substance, at concentrations ranging from 0·01 to 10 p.p.m., to the soil in which the diseased plants were growing, resulted in an average increase of powdery mildew colonies on the variety No. 45 (susceptible to race 2) of 1·3 to 1·5 times over the control, while the amount of necrosis on the resistant selection 28949 exceeded that on the untreated plants by 2·1 to 2·8 times. These results are considered to be statistically significant.

When leaves from the mildew-free plants of the No. 45 variety were excised, inoculated, and maintained on a sucrose solution enriched with varying quantities of thiamin, no statistically significant effect on the disease was apparent as compared with the controls, though the lower concentrations tended to increase mycelial growth. Applications of thiamin solutions of 0·01 p.p.m. to the soil of mildew-free plants of No. 45 significantly increased mildew growth on excised leaves from these plants, inoculated and maintained on a sucrose solution. Higher concentrations of thiamin gave inconclusive results.

From these results and from indirect evidence from other work the author concludes that growth of the fungus on cantaloupe is either directly or indirectly increased by thiamin.

Pryor (D. E.) & Whitaker (T. W.). **The reaction of Cantaloupe strains to powdery mildew.**—*Phytopathology*, xxxii, 11, pp. 995–1004, 1 fig., 1942.

At the United States Horticultural Field Station, La Jolla, California, cantaloupe plants differing in their reactions to powdery mildew (*Erysiphe cichoracearum*) were inoculated in the greenhouse with physiologic race 2 of the fungus. The resultant symptoms are described and assigned to five classes, based on the range of mycelial development and extent of sporulation from 0 (absence of visible growth) to 4, representing an abundance of vigorously sporulating mildew growth. The leaves and cotyledons of some plants further responded by the production of faint yellow to definitely necrotic spots, usually with little or no mycelium, while a longitudinal cracking of the stems was also occasionally observed.

Duplicate plantings of 18 cantaloupe strains, comprising selections from Hale's Best (susceptible to races 1 and 2 of the mildew), Powdery Mildew Resistant Cantaloupe No. 45 (resistant to 1 but not to 2), a strain highly resistant to both races, and several selections believed to be tolerant of 1 and 2, were made in the greenhouse and on three different dates (4th and 23rd December, 1940, and 27th January, 1941) in the field. In the greenhouse all the strains except the one resistant to both physiologic races of *E. cichoracearum* developed a 4 reaction on the leaves, stems,

and cotyledons, the last-named being in general the most susceptible organ. The severity of the disease increased in each successive field planting, all the plants in the third, except those of the highly resistant selection, showing a 4 reaction. Most of the tolerant strains gave a more satisfactory performance than No. 45 in the first planting, and several were superior to it in the second.

The writers' method of obtaining data on mildew resistance, involving a study of the reactions of individual plants both in the greenhouse and subsequently in the field, is regarded as much more reliable than field trials alone for the purpose of selection.

HOWARD (F. L.) & DESROSIERS (R.). **Studies on the resistance of Eggplant varieties to Phomopsis blight.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 337–340, 1941.

In greenhouse and field trials at the Rhode Island Agricultural Experiment Station, Black Beauty, Early Long Purple, and Rhode Island hybrid (F_3—5—1) eggplant varieties were assigned indexes of 3 in a classification ranging from 0 to 4 in order of increasing susceptibility to *Phomopsis* [*Diaporthe*] *vexans* under the latter conditions as compared with one of 4 under the former. Two collections of the Brazilian Gilo variety, a tall shrub with small, red fruits, were immune, as also were *Solanum indicum*, *S. pyracanthum*, *S. mammosum*, and other unidentified types, while a high degree of resistance was exhibited by the Indian Pegan and Bengal strains.

The results of inoculation experiments carried out to determine the nature of the factor conferring resistance to *D. vexans* on certain eggplant varieties indicated that chemical or protoplasmic processes are involved rather than structural or mechanical, since the pathogen enters the leaves of both susceptible and resistant varieties by direct penetration of the upper and lower epidermal cell walls. In its parasitic phase *D. vexans* appears to be confined to living eggplants, but as a saprophyte it is capable of luxuriant growth on the sterile vegetative structures of a number of field and garden crops, e.g., cauliflower petioles, carrot roots, and beetroots, some of which may serve to perpetuate the fungus indefinitely and thereby lessen the efficacy of rotation as a control measure.

MANUEL (H. L.). **Cold storage of Grapes experiments.**—*Agric. Gaz. N.S.W.*, liii, 11, p. 533, 1942.

In an experiment on the control of mould [unspecified] on grapes in cold storage carried out in New South Wales, Ohanez grapes in cases containing 21 lb. fruit and 2¼ lb. cork were put in storage at about 31° and at 35° to 36° F. on 25th April, 1942, untreated, or with 7 gm. [sodium] metabisulphite [*R.A.M.*, xx, p. 287], 21,14, and 7 gm. sodium bisulphite, or 20 gm. flowers of sulphur mixed with the cork.

Inspection on 30th July showed that both metabisulphite and sodium bisulphite had been distinctly advantageous in preventing mould growth. The sodium bisulphite appeared to keep the stalks in better condition as regards colour than the metabisulphite, the dosage of which should probably be increased to 10 to 12 gm. per half case. The lower temperature was found to be the more suitable, and it is suggested that the storage temperature should be kept at 29°.

Further examination on 11th September showed that the storage period had then become too long, though the grapes treated with metabisulphite and sodium bisulphite (particularly the latter) were more or less free from mould.

If cases of the size used for export are treated, the amounts of the chemicals mentioned should be increased by about 36 per cent.

PENTZER (W. T.) & BARGER (W. R.). **A comparison of fungicidal treatments for the control of Botrytis rot of Grapes in storage.**—*Proc. Amer. Soc. hort. Sci.*, xxxix, pp. 280–284, 1941.

None of the 12 treatments tested for the control of *Botrytis* [*cinerea*] in Emperor

grapes stored for ten weeks at 32° F. and 85 per cent. relative humidity at the Fresno (California) branch of the United States Department of Agriculture in 1940–1 proved equal to 20 minutes' fumigation by 1 per cent. sulphur dioxide [*R.A.M.*, xix, p. 25], which reduced the incidence of infection from $38 \cdot 6 \pm 4 \cdot 10$ in the uninoculated control to $3 \cdot 7 \pm 0 \cdot 81$ per cent. Significant decreases in the amount of rot were obtained with four other treatments, viz., ortho-phenyl phenol wraps ($7 \cdot 3 \pm 1 \cdot 43$), iodine-potassium iodide wraps ($9 \cdot 6 \pm 1 \cdot 64$), formalin spray ($13 \cdot 00 \pm 2 \cdot 33$), and ethyl alcohol dip, followed by waxing ($22 \cdot 8 \pm 2 \cdot 64$), but their undesirable effects on the fruit (except formalin) rendered them unsuitable for the purpose in view.

CUNIN (G.). **Dépérissements de la Vigne dans la région de Philippeville.** [Vine wilts in the region of Philippeville.]—*Ann. Inst. agric. Algér.*, i, 2, pp. 100–125, 9 figs., 1 graph, 1942.

An account is given of six years' investigations in the field of cases of vine wilting occurring in the vicinity of Philippeville, Algeria. Vines affected by what is termed locally 'court-noué' were found to show a whole series of somewhat similar symptoms due to parasitic or physiological causes. The author strictly confines the use of the term 'court-noué' to vines showing branches with nodes closely approaching one another, and therefore with internodes very short in relation to their diameter, but not showing the presence of any specific physiological or parasitic cause. This form of the disease represents less than 10 per cent. of the pathological cases observed in the area concerned. It is most common in places with a compacted, damp subsoil. On adult vines it is persistent, and not, as on young ones, merely associated with unfavourable climatic conditions. The available evidence indicates that the form of court-noué found in France and considered by Branas to be associated with a virus [*R.A.M.*, xix, pp. 66, 67] is rare, if at all present, locally.

More than 50 per cent. of the cases of vine wilt observed round Philippeville take the form of rachitism of the branches with pith disease. This condition generally affects young vines and occurs in all sorts of localities. The outward symptoms show no specific characters, the disease being recognized in its early stages by the presence of thin branches which lack vigour and may be unproductive. A year later, rachitism becomes apparent, the affected branches averaging not more than 25 cm. in length; they bear no bunches, but the internodes are, proportionally, of normal length. During the third year, the shoots, which are numerous and develop especially on the secondary buds, average only 10 cm. in length. On the 'cordons' the buds on the distal part fail to open. At this stage, the scanty vegetation is stunted and bushy. The leaves are very small, much deformed, and sharp-toothed. The axes of the branches are not straight and the nodes are very close together; ripening is absent or incomplete. By the spring of the fourth year, the affected vines seldom show any vegetation. Death generally ensues within three years of the appearance of the first distinct external symptoms.

If the stem and branches of an affected vine are cut open, the pith is found to be brown or black, according to the stage reached by the disease; it may even have disappeared, leaving a cavity with black walls. The discoloration frequently affects the neighbouring wood. This pith discoloration may arise (1) from pruning wounds, in which case the disease spreads downwards, (2) from the open heel of the cutting, the disease then progressing upwards, (3) from a wound in the stem, caused by a plough or pick, the disease then spreading both upwards and downwards, and (4) from two or three sites of entry simultaneously, in which case the pith of all the organs rapidly becomes affected. In the last three cases, it is evident that the disease cannot be arrested. With reference to the first, an experiment was conducted in which ten eight-year-old vines, affected with rachitism of the

branches in the second and third stages, were selected, the affected parts of the stem were cut away to a depth of 10 cm. below the soil-surface, and split grafting was carried out (in April, 1935) with grafts obtained from healthy parts of the vineyard. The young grafts have since that date remained normal and the vines have given a yield almost equal to that of healthy ones. From this it is concluded (1) that the discoloration of the pith may assume a parasitic form associated with the vegetative condition of the vine, (2) that infection does not always come from the soil, so that replanting may in some cases be advisable, and (3) that when infection takes place through pruning wounds, timely re-grafting may be undertaken in suitable soils.

Material showing the pith discoloration was sent for examination to P. Marsais, who failed to detect the presence of *Pumilus medullae* [ibid., xviii, p. 294] but who stated that, in his opinion, the fungus might be the cause of rachitism. Identical specimens were dispatched to R. Maire, who stated that the pith was invaded by sterile mycelia penetrating the wood. Thus, the organism present in the pith of rachitic vine branches has not yet been identified, but the author is certain that one or more fungi are present, perhaps saprophytically, but capable, under certain circumstances, of becoming true parasites.

This condition of rachitism of the branches accompanied by pith discoloration is found in widely different localities. Different ecological types of the disease exist, determined by the relation between the vine and the soil on the one hand, and the vine and the atmospheric conditions on the other. Three main types of this sort are distinguished. Type A is a parasitic type found in poor soils, and also affecting vines weakened by over-production. Death usually supervenes two years after the definite appearance of the pith disease, which is not able to affect all the organs before death ensues. Type B is found in damp, compacted soils. In these cases, the roots often become asphyxiated, the vine is in a poor vegetative condition, with the result that nutrition is defective, and it becomes predisposed to attack by pith disease, with penetration through the heel of the 'cutting'. Death occurs either when root asphyxiation is serious and the pith disease still in an early stage, or when only a few roots have become asphyxiated, but the pith is severely affected. Type C is the 'valley type', and occurs near river banks. The only apparent cause of weakening is slight over-production in some years; when dying vines are cut open it is seen that the pith disease, after effecting its entry chiefly through pruning wounds, has become the essential cause of the wilt, is widespread, and has reached almost its final stage of development. This takes at least three years.

The following preventive methods against pith disease are recommended. (1) Plants obtained from the nursery must be completely healthy. (2) Before planting all doubtful vines must be eliminated. (3) Avoid planting too deeply if the soil is damp and rather compact. After pruning, spraying should be effected, using sulphuric acid (10 per cent. by weight), at the same time taking all necessary precautions against attack by fungi and insects. All attempts at a cure by means of chemical fertilizers or chemical treatments are useless.

PADWICK (G. W.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1940–1*, pp. 52–56, 1942.

During the period under review [cf. *R.A.M.*, xxi, p. 1] 54 wheat varieties were included in the trials for resistance to loose smut [*Ustilago tritici*]. Of these, five have remained immune for four years, and three selections maintained their resistance in the experiments under discussion, while ten other varieties have contracted no infection since their first exposure to the fungus in 1938–9 and selections among a further four are showing promise.

The best of five disinfectants tested for the control of barley covered smut (*U. hordei*) at Delhi was agrosan G, followed by sulphur dust, whereas in a

comparable series of trials at Karnal the relative positions of the two fungicides were reversed.

The general level of infection in the gram [*Cicer arietinum*] wilt (*Fusarium orthoceras* var. *ciceri*) experiment was lower during the past year than in the two previous seasons, but the high degree of susceptibility of the Imperial Pusa 9, I.P. 26, and I. P. 29 varieties, with 51, 34, and 66 per cent. disease, respectively, was confirmed, I. P. 28 again occupying an intermediate position (11 per cent.) [loc. cit.]. A well-marked correlation was observed between wilt and subsoil dryness at Karnal and Delhi, while late sowing, as in previous experiments, reduced the incidence of the disease.

Negative results were obtained in attempts to render white flies (*Bemisia gossypiperda*) infective for the tobacco leaf-curl virus by feeding them on juice extracted from diseased plants, thereby failing to confirm the partially successful outcome of previous tests.

Some interesting observations, in addition to those already mentioned, were made in connexion with the epidemic of red rot (*Colletotrichum falcatum*) in the sugar-cane crops of northern Bihar and the eastern United Provinces [ibid., xxi, p. 347]. For instance, quite a close association was established between the occurrence of *C. falcatum* and that of wilt (*Cephalosporium sacchari*). A good deal of secondary red-rot infection was found to take place through the nodal region: out of some 1,000 affected canes examined from 69 localities, 228 showed evidence of invasion of the upper stem nodes without any sign of basal rot.

Roguing was once more found to be efficacious in the control of sugar-cane smut (*U. scitaminea*), only 44 diseased clumps having been eradicated over an area of 13·6 acres in April and May, 1941, as against 319 for the corresponding period of 1940.

A species of *Cytospora* was responsible for a severe die-back and decortication of pears in the North West Frontier Province.

A new species of *Phyllosticta* caused a leaf disease of *Hibiscus sabdariffa* at Dacca.

BERTUS (L. S.). **Plant pathology.**—*Adm. Rep. Dir. Agric. Ceylon, 1941*, p. D5, 1942.

During the period under review [cf. *R.A.M.*, xxi, p. 66], the presence of mycorrhiza on cardamom roots was found markedly to stimulate production and to benefit the health of the trees, which gave unsatisfactory yields on soils where these structures were absent, presumably owing to deficiency of organic matter.

The mosaic of *Hibiscus esculentus* was found to be transmissible by white flies fed on infected plants, denoting its virus origin. A disease of young coco-nut palms resembling the 'bitten leaf' of Jamaica [ibid., xv, p. 136] is tentatively attributed to *Thielaviopsis* [*Ceratostomella*] *paradoxa*.

A stem and leaf disease of two Indian varieties of *Piper betle* now established in Ceylon, caused by *Colletotrichum piperis* [ibid., xix, p. 260], is prevalent, but readily controllable by spraying the vines with colloidal copper.

An experimental consignment of Surat ginger from Hong Kong was severely infected by *Pythium myriotylum*, but successful multiplication was effected by the isolation of healthy seed pieces from the diseased clumps.

CROSS (W. E.). **Notas sobre el progreso de la agricultura y las industrias agropecuarias de Tucumán durante los últimos sesenta años.** [Notes on the progress of agriculture and the livestock industries of Tucumán during the last sixty years.]—*Bol. Estac. exp. agríc. Tucumán* 36, 75 pp., 11 figs., 1942.

Included in this review of the advances made in the progress of agriculture (with special reference to the sugar-cane industry) during the past sixty years in Tucumán, Argentine, are references to a number of cane pests and diseases, including the newly discovered smut (*Ustilago scitaminea*) [*R.A.M.*, xxi, p. 481],

ring spot (*Leptosphaeria sacchari*), lineal leaf spot (*Phyllosticta sacchari*), cold [banded] chlorosis, ring rot (*Melanconium* [*Pleocyta*] *sacchari*), root disease, stump rot, and spring chlorosis [ibid., xviii, p. 237]. Fungi occurring on the same crop in other parts of the Republic but not yet recorded in Tucumán comprise sooty mould [*Capnodium* spp.] in Santa Fe and Corrientes, red rot (*Colletotrichum falcatum*) in Salta, and wilt (*Cephalosporium sacchari*) and black rot (*Ceratostomella paradoxa*) in Jujuy.

Braun (A. C.) & Laskaris (T.). **Tumor formation by attenuated crown-gall bacteria in the presence of growth-promoting substances.**—*Proc. nat. Acad. Sci., Wash.*, xxviii, 11, pp. 468–477, 3 figs., 1942.

An attenuated culture of *Phytomonas* [*Bacterium*] *tumefaciens* (Hendrickson and collaborators' A66) [*R.A.M.*, xiv, p. 289] was experimentally shown to be capable of inducing the formation of large tumours in Bonny Best tomato plants in the presence of the growth-promoting substances, α-naphthalene-acetic acid, β-indole acetic acid, and γ-indole butyric acid, applied three times at seven-day intervals at concentrations of 0·5, 1, 1·5, and 2 per cent. in lanoline to the decapitated stems. The excrescences resulting from treatment with α-naphthalene-acetic acid approximated most closely to those arising from the virulent culture used for comparative purposes, being white and of irregular contour in contrast to the brown, regular outgrowths due to the other substances. It was further demonstrated, by means of grafting tests, that the cells of the artificially induced tumours can be transplanted in series and give rise to neoplasms reaching a diameter of 3 to 4 cm. in four to five weeks in their new hosts. Some of the tumours developing in this manner were apparently free from bacteria [ibid, xxi, p. 6; xxii, p. 12]. Without the aid of the growth-promoting substances the attenuated culture was unable to stimulate cellular multiplication to any appreciable degree.

Riker (A. J.) & Baldwin (I. L.). **Names for the bacterial plant pathogens.**—*Chron. bot.*, vii, 6, pp. 250–252, 1942.

The authors stress the need of an adequate system for the classification of bacterial plant pathogens, stating that at present workers in the United States occasionally still use Migula's or E. F. Smith's classification, in rare cases employ classifications developed abroad, while most follow Bergey's system. While the last-named system is considered superior to all previous ones, it is still not entirely satisfactory as closely related non-pathogenic forms fail to appear in proper relationship to the pathogens. It is hoped that when an improved system of classification is worked out, physiologically related groups of organisms will be found placed together. For the study of bacterial pathogens the consideration of pathogenic together with attenuated or closely related non-pathogenic cultures is of extreme importance. Essential also is the purity of cultures, and single-cell isolations should be used when single-colony cultures show critical variability.

Mehta (K. C.). **Control of rust-epidemics of Wheat and Barley.**—*Indian Fmg*, iii, 6, pp. 319–321, 2 pl., 1942.

Summarizing the results of a prolonged investigation into the problem of cereal rusts [*Puccinia* spp.] in India [*R.A.M.*, xx, p. 292], the author states that with nearly 35,000,000 acres under wheat, India is at present the largest producer of wheat in the British Empire. All three rusts, yellow, brown, and black [*P. glumarum*, *P. triticina*, and *P. graminis*, respectively] are moderately common. Yellow rust, because of the heat, does not thrive in the plains of Peninsular India, where brown rust is also rather scarce, but in the Nilgiris and Palni hills all three rusts are abundantly present. The yellow and black rusts also attack barley, which

covers nearly 8,000,000 acres. The source of all three rusts lies in the hills [ibid., x, p. 710; xviii, p. 511]; yellow rust, unable to oversummer at heights below 6,000 ft., would appear to be blown down from higher altitudes, while the other two are probably disseminated from comparatively low elevations.

Owing to the earliness of the local crops, central Nepal in the north and (taken together) the Nilgiris and Palni hills in the south provide two important foci of infection. In addition, hills 6,000 ft. high or more are potential foci of all three rusts, and black and brown rusts may occasionally be disseminated from altitudes of nearly 4,000 ft. and above.

In the hills the incubation period may vary from three to four weeks, but in the plains it generally lasts only 10 to 12 days.

The best method of control would be to suspend the cultivation of wheat and barley in the hilly areas for two or three years. Alternatively, only resistant varieties should be grown in the hills, but such varieties have not yet been developed. A third possible method would be to destroy all 'out-of-season' wheat and barley (self-sown plants, ratoon tillers, and stubble) one to two months before sowing in all hilly areas. Lastly, in view of the small acreage under early crops in the Nilgiris and Palni hills and central Nepal, suspension of the first crop (sown during April–June) in the first two areas and postponement of sowings in the third area to October should offer effective control in most of Peninsular India and the Indo-Gangetic plain, respectively. The last two methods are thoroughly practicable and at the same time inexpensive. They have been approved for trial by competent bodies of the Imperial Council of Agricultural Research and by a number of scientists outside India, and it now remains for the provincial Governments and the States concerned to test their efficacy over a number of years simultaneously. For the success of control by 'clean-up' all those owning land in the hills as well as every cultivator in these areas must co-operate.

NEWTON (MARGARET) & JOHNSON (T.). **Adult plant resistance in Wheat to physiologic races of Puccinia triticina Erikss.**—*Canad. J. Res.*, Sect. C, xxi, 1, pp. 10–17, 1943.

The reaction of nine wheat varieties, in the seedling as well as in the heading stage, to *Puccinia triticina* [*R.A.M.*, xx, p. 354] (races 1, 2, 3, 5, 9, 15, 20, 27, 28, 29, 31, 34, 39, 41, 44, 52, 53, 58, 71, 76, 83, 89, 103, 104, and 130) was studied at Winnipeg, Manitoba. In greenhouse experiments it was found that the wheat variety Regent, susceptible or moderately so to seven races in the seedling stage, was resistant to all of them and to 12 additional races in the heading stage; Renown, moderately resistant as a seedling, showed in maturity increased resistance to all the 19 races tested. In the field, both varieties showed similar adult resistance to races 5, 9, 71, and 76. It is suggested that in these two wheat varieties, and possibly in other derivatives of H–44 and Hope, adult resistance to *P. triticina* may be a generalized phenomenon comparable to their resistance to *P. graminis tritici*. The varieties Thatcher, Apex, Marquis, Reward, and Kenya R. L. 1373, susceptible in the seedling stage to all the races tested, showed an adult resistance to some only of these races. This type of resistance, not previously observed against other cereal rusts, is considered to be of little practical value unless the particular races against which it is operative should happen to predominate in a natural epidemic. The McMurachy variety was found to be susceptible in both stages of development, although it showed slight adult resistance to one race only in the field. Finally, Warden × Hybrid, tested only in the field, proved immune from, or highly resistant to, all four races used. Adult plant resistance was observed to be usually greatest in the uppermost leaves, diminishing downwards.

HOLTON (C. S.). **Extent of pathogenicity of hybrids of Tilletia tritici and T. levis.**—*J. agric. Res.*, lxv, 12, pp. 555–563, 1942.

In studies of 50 hybrids obtained from crosses either between *Tilletia tritici* [*T. caries*] (races T–8, T–9, T–10, and T–12) and *T. levis* [*T. foetida*] (races L–7 and L–8) or between races within these species [*R.A.M.*, xxi, p. 284], approximately 83 per cent. of the inter-species hybrids proved capable of perpetuating themselves as against only 59 per cent. of the inter-race hybrids. On the other hand, the latter were more productive of new pathogenic segregates than the former. The segregates from the various hybrids varied largely in pathogenicity, some being less and others more virulent than the parent races, while still others showed virulence equivalent to that of the parents. Several hybrids were pathogenic to the wheat variety Hussar × Hohenheimer, which is highly resistant to all known races of the bunt fungi, indicating entirely new combinations of pathogenicity factors. It is concluded that pathogenicity in the two fungi is apparently controlled by genetic factors and inherited on a multiple-factor basis. Factors for pathogenicity and spore morphology are inherited independently. The selective influence of the host variety is considered of importance in the expression of pathogenic properties and the establishment of new physiologic types resulting from hybridization.

TYNER (L. E.) & BROADFOOT (W. C.). **Studies on foot and root rot of Wheat. VII. Some factors affecting the health of Wheat seedlings in nutrient solutions.**—*Canad. J. Res.*, Sect. C, xxi, 1, pp. 18–25, 1943.

In further studies in Alberta on the foot-rot diseases of wheat caused by *Helminthosporium sativum* and *Fusarium culmorum* [*R.A.M.*, xvii, p. 784; cf. also xx, p. 397], the effect of iron tartrate on the development of chlorosis in wheat seedlings grown in nutrient solutions, and also the effect of extracts of the two pathogens on disease expression, were studied in the greenhouse. Less iron was required in summer than in winter, but generally the addition of ferric tartrate solution at the rate of 1 ml. of 0·5 per cent. strength per 1 l. of nutrient solution three times a week proved effective in preventing chlorosis all the year round. Less iron was required in solutions with a hydrogen-ion concentration adjusted to P_H 5·5 twice weekly than in those with an approximately neutral reaction. The addition of manganese appeared to have no effect on chlorotic development in wheat seedlings grown in nutrient solutions deficient in iron. Sterilized and unsterilized filtered extracts of the two fungi added to the nutrient solutions were found to inhibit the growth of wheat seedlings, an effect interpreted as an expression of pathogenicity.

BRIGGS (F. N.) & STANFORD (E. H.). **Linkage relations of the Goldfoil factor for resistance to mildew in Barley.**—*J. agric. Res.*, lxvi, 1, pp. 1–5, 1943.

In continued studies in California on the inheritance of resistance to mildew (*Erysiphe graminis hordei* race 3) in barley [*R.A.M.*, xx, p. 356], the authors investigated a cross between the resistant variety Goldfoil (Goldfoil factor, Ml_g, for resistance), which is hulled, awned, and white, but carries the Bl factor for blue aleurone and develops red pigment in the stems under favourable light conditions, and the susceptible Nepal 595, which is naked, hooded, and white, but has the Bl_1 factor for blue and green stems. It was found that mildew resistance in the progeny of this cross was linked with hooded (K) with a cross-over of 18·77 ± 2·33 per cent., and with the Bl factor, 26·31 ± 5·05 per cent. The two factors K and Bl have been shown by other workers to be linked with a value of 22·58 ± 0·82 per cent. and assigned by them to linkage group IV. As these factors enter in the repulsion phase, the probable errors are considered to be relatively high and the order of the three genes under consideration not clearly indicated. The order suggested is Bl, K, Ml_g. The red colour of the stems was found to be due to a single factor designated Rs, linked with hulled (N), 14·50 ± 1·06 per cent., and with a

second factor for blue aleurone (Bl_1) with a cross-over value of $9{\cdot}07 \pm 1{\cdot}24$ per cent. These genes have been assigned to linkage group III. The order of these three genes is again not clearly indicated, but is suggested to be N, Bl_1, Rs.

TAPKE (V. F.) & BEVER (W. M.). **Effective methods of inoculating seed Barley with covered smut (Ustilago hordei).**—*Phytopathology*, xxxii, 11, pp. 1015–1021, 1 fig., 1942.

A tabulated account is given of experiments in Idaho and New York State in 1936 and 1937 in the inoculation of the Hannchen, Odessa, and Trebi barley varieties with covered smut (*Ustilago hordei*) [*R.A.M.*, xix, p. 697] by two methods involving modifications of Haarring's 'evacuation' technique for the infection of oats with *U. avenae* (*Bot. Arch.*, xxix, pp. 444–473, 1930), both of which proved greatly superior in the production of the disease to the standard practice of coating the surface of the seed with spores, the averages of infection obtained at three stations in 1936 by the two new methods (spore suspension and spore suspension under vacuum) being 46·9 and 49·5 per cent., respectively, compared with 16·8 for dusting the seed. The three essential features of the modified technique are (1) pre-treatment of the seed-grain with formaldehyde, followed by washing in water and drying to eliminate surface-borne contaminants and loosen the hulls round the caryopsis, thereby materially enhancing the effectiveness of the inoculation besides incidentally increasing the efficacy of dusting with copper carbonate; (2) covering the seed with spores in suspension, which are carried beneath the hulls and brought into proximity with the site of invasion, as under natural conditions; and (3) 16 to 20 hours' storage of the inoculated seed-grain in a moist state to promote spore germination and the spread of inoculum before drying and sowing.

Although the vacuum method resulted in slightly heavier infection than the spore-suspension technique the latter appears to be more advantageous and simpler of application for large-scale inoculations, particularly those entailing a study of physiologic specialization.

DILLON WESTON (W. A. R.) & TAYLOR (E.). **Seed disinfection V. The stripe diseases of Barley and Oats.**—*J. agric. Sci.*, xxxiii, 1, pp. 23–27, 2 pl., 1943.

In this paper [cf. *R.A.M.*, xxi, p. 131] the authors state that in 1924, 15 samples of oat seed were received at the Official Seed Testing Station, Cambridge, from farmers who reported that sowings from this seed had failed in the previous season; all the samples showed the presence of *Helminthosporium avenae* [ibid., xxii, p. 128], infection ranging from 20 to 70 per cent. Of 100 samples of Scottish seed examined 77 showed infection, which ranged from 5 to 95 per cent. In 1932–3, 50 random samples of oat seed received at Cambridge were examined, and 48 were found to be infected, infection ranging from 2 to 68 per cent. In 1942, 100 random samples from the 1941 crop were examined, and 90 were found to be infected, the degree of infection ranging from 1 to 98 per cent., and reaching over 50 per cent. in 24 of the samples.

From 1923 to 1942 the incidence and intensity both of this disease and of barley leaf stripe (*H. gramineum*) [loc. cit.] were studied in the field and in experimental plots. Numerous barley and oat crops in East Anglia were examined, and surveys were also made periodically in Norfolk, Suffolk, and Cambridgeshire. From 1923 to 1933 it was exceptional to find a commercial crop in the seedling stage completely unaffected. In 1925, a high germinating sample of Black Supreme seed oat known to be infected with *H. avenae* was sown in the field; 4,560 seeds were sown, of which 2,001 emerged. Primary *H. avenae* injury (visible above ground) was shown by 916 seedlings, and *H. avenae* infection of, probably, a secondary nature by 126. There were only 781 healthy seedlings. Of the 1,042 seedlings which showed *H. avenae* injury, 50 died later on. Some seedlings which failed to braird, developed

mycelia and spores of *H. avenae* after incubation, indicating that the underground rotting had been due to pre-emergence blight caused by the fungus. In this case, while only 5 per cent. of the attacked seedlings which appeared above the ground died, 56 per cent. of the total seed sown was killed before emergence, the evidence indicating that this mortality was partly due to *H. avenae*.

Little progress was made in control by seed treatments until organo-mercury seed dressings became available, from 1932 onwards [loc. cit]. In 1941–2 six well-known such dressings (A to F) were tested for the control of barley leaf stripe, with copper sulphate, copper carbonate, and formalin. Treatments A to F gave, respectively, 0·27, 0, 0·18, 0, 0·38, and 0·19 per cent. affected seedlings, as against 32·53, 33·37, 33·7, 36·87, 34·42, and 33·54 per cent. for the corresponding untreated controls, while the figures for copper sulphate, copper carbonate, and formalin were, respectively, 6·59, 29·43, and 27·77 per cent., as against 32·78, 37·63, and 34·39 for the controls. Dressings B, C, and D were used at the reduced rates of 1 oz. and ½ oz. per bush.

Experimental evidence was obtained that barley straw infected with *H. gramineum* may be a fertile source of secondary infection, plots strewn with such straw showing from 8·02 to 18·32 (mean 14·51) per cent. infection compared with 0·062 per cent. for the control.

It is the killing of oat seedlings by *H. avenae* and barley seedlings by *H. gramineum* between germination and tillering that offers such a serious problem. The authors' field observations showed that when climatic conditions favour the rapid germination and development of the seed and seedling, mortality is low, but if growth is interfered with by adverse climatic conditions, mortality is high. The primary phase is therefore more severe in cold, wet localities than in those that are warmer and drier. Although severely infected seed may produce only low mortality if favourable weather enables the seedlings to escape infection, farmers should, nevertheless, treat their seed before sowing with a reliable organo-mercury dressing as an insurance.

TERVET (I. W.) & HART (HELEN). **Variation in reaction of Anthony Oats to stem rust, Puccinia graminis avenae.**—*Phytopathology*, xxxii, 12, pp. 1087–1090, 1 fig., 1942.

Experimental evidence is adduced for the existence of two morphologically indistinguishable strains of Anthony oats, one of which is susceptible to physiologic race 5 of stem rust (*Puccinia graminis avenae*) in contrast to the normally resistant reaction of the variety [*R.A.M.*, xvii, p. 309]. Some 15 per cent. of a total of 500 adult plants proved to be susceptible to the disease in field plots at St. Paul, Minnesota, and there is thought to be no doubt that the seed lots of Anthony available in the State contain a high proportion of susceptible material. These observations and those of other workers on cereal rusts point to the advisability of periodical re-selection within varieties that have been bred for resistance to a particular pathogen.

ELLIOTT (CHARLOTTE). **A Pythium stalk rot of Corn.**—*J. agric. Res.*, lxvi, 1, pp. 21–39, 11 figs., 2 graphs, 1943.

A stalk rot was observed on two inbred lines of yellow dent maize, K167 and C.I. 6, at the Arlington Experiment Farm, Virginia, in 1940. The infection appeared very suddenly after heavy rain followed by hot weather and ceased as abruptly when the temperature went down. The rot, usually confined to the lower internodes, affected all tissues of the stalk except the vascular bundles, causing the plants to fall over, while the tops remained green and turgid for several days after. The rotted, dark brown, water-soaked areas were clearly separated from the healthy tissues by a line of demarcation, often of a purplish or lavender

tinge. The fungus isolated from diseased tissues in pure culture was identified by C. Drechsler as *Pythium butleri*, and its pathogenicity was proved in field and greenhouse inoculations. These were successful on both wounded and unwounded stalks, but only under conditions of high temperature and humidity. Twelve inbred lines and C. I. 6, inoculated in the greenhouse, varied in their resistance to the fungus, C. I. 5, Ia. L289, C. I. 1, and C. I. 540 being susceptible, and Ill. Hy. and Ky. 13 resistant. Squashes (*Cucurbita pepo*) and cucumbers inoculated with cultures of the fungus were rapidly covered with dense mycelium and developed water-soaked areas.

A similar stalk rot was observed in a small field of hybrid maize near Petersburg, Virginia, in 1941. Although isolations from the rotted stalks failed to yield *P. butleri*, probably owing to the known difficulty of isolating species of this genus, the disease is believed to be identical with that described above.

LEUKEL (R. W.). **New fungicides and reduced fungicide doses for the control of kernel smut of Sorghum.**—*Phytopathology*, xxxii, 12, pp. 1091–1093, 1942.

A tabulated account is given of experiments at the Bureau of Plant Industry Station, Beltsville, Maryland, and at seven other locations in the mid- and southwest on the control of covered smut of sorghum [*Sphacelotheca sorghi*] by the application to Sharon Kafir seed-grain, previously inoculated with spores at the rate of 1 gm. per 100 gm. of new improved ceresan ($\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ oz. per bush.), copper carbonate, spergon, thiosan (Du Bay 1205-FF) containing 50 per cent. tetramethylthiuram disulphide, Du Bay 870 (100 per cent. ferric dimethyl dithiocarbamate), captax (100 per cent. mercaptobenzol-thiazole), obtainable from the R. T. Vanderbilt Company, sanoseed (2·2 per cent. ethanol mercuric chloride) from the Ansbacher Siegle Corporation, M.T.D.S. (morpholine thiuram disulphide) supplied by M. C. Goldsworthy, and dusting sulphur (Stauffer Chemical Company), all at dosages of 3, 1$\frac{1}{2}$, and $\frac{3}{4}$ oz. per bush. Spergon gave perfect control of the disease, which was further reduced to an average of under 0·1 per cent. by thiosan and Du Bay 870 at all concentrations, while M.T.D.S. and copper carbonate were only slightly less effective. Captax and sulphur gave fairly satisfactory results at full strength, being superior to new improved ceresan, the two-year-old sample of which had evidently deteriorated; sanoseed was useless for the purpose in view. The incidence of infection in the untreated control rows ranged from 7·8 to 43·4 (average 25·2) per cent., so that uniformly exacting conditions for the treatments were not provided. However, the outstanding success of the applications with the new materials, thiosan, Du Bay 870, and M.T.D.S. at all rates (the first-named already on the market as a fungicide for turf [*R.A.M.*, xix, p. 656; xxi, p. 383], the two latter still in the experimental stage), and with captax (used in rubber manufacture) at the maximum strength, indicates their potential value in the control of certain diseases of other crops. Emergence was most consistently benefited by thiosan, Du Bay 870, copper carbonate, and spergon.

Phenyl mercury oleate prevents mildew in experiments on tents used to fumigate for control of insect pests of Citrus.—*Agric. News Lett.*, x, 4, pp. 80–81, 1942. [Abs. in *Biol. Abstr.*, xvii, 1, pp. 281–282, 1943.]

Phenyl mercury oleate [*R.A.M.*, xxii, p. 144] is an effective compound for the control of mildew on the tents used for fumigation operations against citrus pests, being highly antiseptic, water-insoluble and therefore not subject to leaching, relatively non-volatile, and does not react with hydrogen cyanide in such a way as to impair its utility or injure the trees. Applications of 0·2 lb. of the compound per 100 lb. fabric should prevent the development of mildew for two or more seasons, provided reasonable care is taken after treatment.

REINIGER (C. H.). **Contribuição ao estudo dos possíveis insetos vetores de virus dos "Citri" no Brasil.** [A contribution to the study of the potential insect vectors of 'Citrus' viruses in Brazil.]—*Bol. Esc. nac. Agron., Rio de J., 1941*, 2, pp. 225–245, 8 figs., 1942. [English summary.]

The etiology of zonate chlorosis of citrus in Brazil [*R.A.M.*, xvii, p. 595] is still unknown, but assuming it to be due to the agency of a virus, the author carried out detailed studies on a number of potential insect vectors, a full description of which is given.

VASUDEVA (R. S.). **Cotton root-rot control in the Punjab.**—*Indian Fmg*, iii, 11, pp. 592–593, 1942.

The results of the author's experiments in the Punjab on the control of cotton root rot (*Rhizoctonia* [*Corticium*] *solani* and *Macrophomina phaseoli*) by mixed cropping, here briefly summarized in a semi-popular form, have already been noticed from another source [*R.A.M.*, xxi, p. 450].

VASUDEVA (R. S.). **Root-rot disease of Cotton in the Punjab.**—*Indian Fmg*, iii, 10, pp. 536–538, 3 figs., 2 graphs, 1942.

The results of experiments carried out during the last seven years at Lyallpur and Khanewal, Punjab, indicate a close correlation between the date of sowing of American and 'desi' cotton (Mollisoni 39) and the mortality from root rot (*Rhizoctonia* [*Corticium*] *solani* and *Macrophomina phaseoli*) [see preceding abstract], a marked reduction in the incidence of which was observed in the early April and late June plantings. In Mollisoni 39 plots at Lyallpur, for instance, the amount of infection in a recent test fell from 61 per cent. in the May sowings to 11 and 3 per cent. in those of mid- and late June, respectively. In American cotton in the locality the mortality among plants of 4th April and 16th May, 1940, sowings was 0·05 and 46·66 per cent., respectively, the corresponding figure for the plot laid down on 30th June (which gave the heaviest yield) being 0·76 per cent.; similar results were also obtained at Khanewal. The average annual loss from root rot over the entire province of the Punjab, where the crop occupies an area of 3,100,000 acres (1937–8), may be roughly estimated at 3 per cent., representing an approximate financial loss of Rs. 3,150,000.

DASTUR (R. H.) & SINGH (S.). **Studies in the periodic partial failures of the Punjab-American Cottons in the Punjab, VI. The effect of sodium salts on growth of plants and development of tirak.**—*Indian J. agric. Sci.*, xii, 4, pp. 603–626, 1 pl., 12 graphs, 1942.

Section I of this report deals with the writers' investigations at the Punjab Agricultural College, Lyallpur, on the growth of native and American cotton varieties in (*a*) normal soils in which 'tirak' (bad opening of the bolls) [*R.A.M.*, xxi, p. 449] was absent, (*b*) and (*c*) sandy loams and light sandy soils, respectively, with saline subsoils where the disease was known to occur, while in section II a tabulated account is given of the results of experiments to determine the effects of artificial applications of sodium salts to a non-saline normal field on the development of American cotton plants.

The growth and yields of the crops were found to be depressed in the presence of salinity in the subsoil, especially in sandy loams, 'tirak' being observed in all such cases and also developing in fields to which sodium chloride was applied at the rate of 16,000 lb. per acre. This compound appears to be chiefly responsible for the disorder under discussion, the first-named author and K. M. Samant (*Indian J. agric. Sci.*, 1942) having shown that the bicarbonate and sulphate are not toxic at the concentrations in which they normally occur, while the carbonate is not always present in susceptible soils. The presence of salts other than the chloride

may, however, aggravate or lessen 'tirak', according to their relative proportions and concentrations.

Ray (W. W.). **The effect of Cotton seed dusting on emergence of seedlings in soil infested with Rhizoctonia.**—*Phytopathology*, xxxiii, 1, pp. 51–55, 1943.

A tabulated account is given of a series of tests at the Oklahoma Agricultural Experiment Station in the control of *Rhizoctonia* [*Corticium*] *solani* on Deltapine cotton [*R.A.M.*, xxi, p. 331], grown in heavily infested greenhouse soil, by seed-dusting with a number of chemicals. Emergence was substantially improved by treatment with new improved ceresan, Du Bay 1155–HH (ethyl mercury iodide), Du Bay 740–A (ethyl mercury borate), Du Bay 1228–R (methyl mercury naphthol sulphamide), and spergon, all applied at the rates of 3 gm. per kg. seed; but the differences in the subsequent survival of plants from the disinfected and control lots were not statistically significant, so that the practice of seed-dusting cannot be regarded as an effective means of combating post-emergence damping-off of cotton seedlings in soils containing an abundance of inoculum of *C. solani*.

Berger (E. W.). **Status of the friendly fungus parasites of armored scale-insects.**—*Florida Ent.*, xxv, 2, pp. 26–29, 1942.

This is a discussion, supplemented by personal observations, of the investigations of P. H. Rolfs (*Bull. Fla agric. Exp. Sta.* 41, 1897) and of the same author and H. S. Fawcett (ibid., 94, 1908) on the entomogenous fungi parasitizing Coccids on citrus, viz., the red-headed scale fungus, *Sphaerostilbe aurantiicola* [*R.A.M.*, xv, p. 216], with which the pink scale fungus, *Nectria diploa*, is thought by some mycologists to be synonymous, the white-headed scale fungus [*Podonectria coccicola*], and the black scale fungus, *Myriangium duriaei* [ibid., xx, p. 61]. *S. aurantiicola* is easily spread to trees infested by this Coccid by simply transferring fungus material. It is able to destroy large numbers of insects without any external sign of its presence: according to W. B. Tisdale, its fruiting bodies are produced on the lower surfaces of leaves that become inverted and so exposed to a stronger light, a similar phenomenon also being apparently essential to the formation of fructifications by the brown white fly fungus (*Aegerita webberi*) [ibid., xvii, p. 161]. *P. coccicola* is believed to have been largely instrumental in arresting a severe outbreak of the long scale [*Lepidosaphes gloveri*, Pack.] in the thirties of the nineteenth century, when the insect was introduced into Florida on citrus trees and caused heavy losses. *P. coccicola* was also the dominant parasite of *L. gloveri* and the purple scale [*L. beckii*, Newm.] towards the close of the same century and the opening of the twentieth, but it is not considered to be indigenous to the State since it has not been detected on native Coccids. *M. duriaei*, another active parasite of Coccids, possesses the drawback of adhesion to the fruits during their preparation for the market.

Verrall (A. F.). **Fungi associated with certain ambrosia beetles.**—*J. agric. Res.*, lxvi, 3, pp. 135–144, 5 figs., 1943.

In the course of a study begun in 1937 by the Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, the following four fungi new to science were found associated with ambrosia beetles in the Southern States: *Endomyces bispora* associated with *Platypus compositus*; *Cephalosporium pallidum* with *Xyleborus affinis*; *C. luteum* with *X. pecanis*; and *Monilia brunnea* with *Pterocyclon mali* and *P. fasciatum*. These fungi are apparently used as food by the beetles and probably cause the restricted black or brown stain in the wood adjacent to the tunnels of the beetles.

McKEEN (C. D.). **A ring spot disease of Gladiolus corms.**—*Canad. J. Res.*, Sect. C, xxi, 1, pp. 1–9, 1 pl., 1 fig., 1943.

A hitherto undescribed disease affecting the corms of stored gladiolus is reported from Vineland, Ontario, under the name of ring spot. The disease is likely to become important economically, as it renders appreciable numbers of corms of certain varieties unfit for sale as propagative lines. The symptoms, which appear in most varieties after 2 to $2\frac{1}{2}$ months of storage or after three or more on a few, consist of somewhat conspicuous, irregularly concentric rings round a node or a root initial. According to the variety, the rings are either narrow, dark reddish-brown and close together or broader and more widely spaced, with occasionally a band of healthy tissue between them. The lesions are at first slightly elevated, but later may quite often become somewhat depressed and hard in texture. They occur more frequently on the lower half of the corm, but in severely diseased specimens both the lower and the upper halves are equally affected. It is generally necessary to remove leaf scales from the corm to determine the presence of the disease with certainty, but in many cases the husks are discoloured and lack lustre. The disease development did not respond to any appreciable extent to modified temperature and moisture conditions of storage, and did not generally progress beyond the seventh month. The progeny of diseased corms produced apparently healthy foliage and bloom, but the corms harvested from such plants invariably developed symptoms in storage.

Histological studies showed that the lesions rarely extend deeper than 15 cells into the corm (or only nine in the variety Amrita). In old lesions groups of collapsed, brownish cells are frequently located near nodes, extending rather deeply into the corm tissue. The lesions are separated from the healthy tissue by a periderm layer five to ten cells thick, which is formed soon after the infection becomes apparent, and may be in part responsible for the small dimensions and shallow depth attained by some of the lesions. From a comparison of susceptible varieties with the apparently resistant King Lear and Camellia, resistance to ring spot would not seem to be due to any obvious morphological characteristics of the corms.

Repeated attempts to isolate a causal agent yielded no single organism consistently, and none of the *Penicillium* and *Fusarium* spp. isolated proved pathogenic in inoculation experiments. Although the exact nature of the disease has thus not yet been established, the author suggests that it is most likely caused by a soil fungus of a low order of aggressiveness, developing at first saprophytically on the corms in storage until such time as conditions become favourable for attack.

SEVERIN (H. H. P.). **Infection of perennial Delphiniums by California-Aster-yellows virus.**—*Hilgardia*, xiv, 8, pp. 411–430, 8 pl., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, pp. 275–276, 1943.]

Delphinium is a relatively uncongenial host of the short-winged (*Macrosteles divisus*) and long-winged leafhoppers, some of which died on the colonized plants after four to six hours and most within 24, hence the delay in the detection of the identity of the virus of California aster yellows on garden varieties [*R.A.M.*, xix, p. 22]. The principal symptoms of infection are dwarfing of the plants and a bunchy growth of short stems; a general foliar chlorosis; phyllody (approximation of the floral organs to leafy structures); and virescence, due to the replacement of floral pigments by chlorophyll. The average experimental infection of two-year-old plants by four vectors viz., the two above-mentioned, *Thamnotettix montanus*, and *T. geminatus*, before and after spike development, was 86·2 and 70 per cent., respectively. The average percentages of virus recovery from naturally and artificially infected *Delphinium* plants by the mountain, geminate, short- and long-winged leafhoppers were 18·3, 14·3, 3·8, and 11·7, respectively. Plants infected

after spike development did not invariably produce green flowers with abnormal floral organs, but after the blossoming period they put out a dense cluster of short, yellow shoots from the crown. The geographical range of the aster-yellows virus hitherto determined embraces Oregon, Washington, Utah, Wyoming, and Colorado, of which the three first-named and Idaho are centres of the newly discovered *Delphinium* disease and harbour either the mountain or geminate leafhopper, or both.

SEVERIN (H. H. P.). **Celery calico on perennial Delphiniums and certain other host plants.**—*Hilgardia*, xiv, 8, pp. 441–445, 6 pl., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 276, 1943.]

The symptoms of celery calico [*R.A.M.*, xviii, p. 369] on perennial *Delphinium* are restricted to the basal and intermediate leaves and include pale or lemon-yellow or amber areas, and line or ring patterns. The incubation period of the disease ranged from 11 to 178 days. Plants infected either naturally or artificially during the first year may act as symptomless carriers in the second. Calico is often associated with aster yellows in *Delphinium* [see preceding abstract] under natural conditions, and the inoculum from such plants produces calico but not aster-yellows symptoms. The aster-yellows virus was recovered from the virus complex by three species of leafhoppers. Tomato plants may contract infection by a mixture of viruses. Cucumber plants inoculated with the virus extract filter out ordinary tobacco mosaic and retain the calico virus, of which nine species of aphids were demonstrated to be vectors.

LIMBER (D. P.) & FRIEDMAN (B. A.). **Erwinia carotovora, the cause of a soft rot in Orchids, Cattleya sp.**—*Phytopathology*, xxxiii, 1, pp. 80–82, 1 fig., 1943.

The organism isolated in pure culture from orchids (*Cattleya* sp.) in New Jersey sporadically affected by a dark, water-soaked rot of the leaves, pseudo-bulbs, and rhizomes was identified as *Erwinia carotovora*, apparently not hitherto reported on this host. Wrinkling of the epidermal tissues of the foliage follows their collapse. The exudate commonly present on the diseased organs turns very dark brown on drying. Inoculation experiments were successful on wounded tissues only of *C.* sp. and *C. mossiae*, foliar decay becoming apparent 24 hours after infection, and complete involvement of the leaf occurring in four to seven days at room temperature. The bacteria readily travel from the leaf to the pseudo-bulb and rhizome, causing the death of the plant. In addition to *Cypripedium* and *Cymbidium*, which were artificially infected by Matsumoto and Okabe with the strain of *E. carotovora* from *Phalaenopsis aphrodite* [*R.A.M.*, x, p. 735], the writers induced soft-rot symptoms on excised leaves of *Oncidium*, *Odontoglossum*, *Brassavola*, and *Lockhartia*.

SMITH (C. O.). **A leaf spot of Hibiscus sp. induced by Phytomonas syringae.**—*Phytopathology*, xxxiii, 1, pp. 82–84, 1 fig., 1943.

The organism cultured from the brown to black, water-soaked spots, 1 to 10 mm. in diameter, sometimes encircled by a yellowish-green zone or halo, on *Hibiscus* leaves in a coastal city of California presented the characters of *Pseudomonas syringae*, and inoculations with the pathogen through wounds on *Hibiscus* leaves and lemon fruits induced the typical symptoms of the disease. Cross-inoculation experiments with the lemon and lilac isolates of the bacterium on *Hibiscus* were likewise successful. Further critical comparative studies are necessary to determine the exact relationships between the various strains of *P. syringae* [*R.A.M.*, vii, p. 515] and the organism described from Japan by Nakata and Takimoto under the name of *Bacterium hibisci* [ibid., ii, p. 413].

STARR (M. P.) & PIRONE (P. P.). **Phytomonas poinsettiae n. sp., the cause of a bacterial disease of Poinsettia.**—*Phytopathology*, xxxii, 12, pp. 1076–1081, 1942.

A technical diagnosis is given of *Phytomonas poinsettiae* n. sp. (or *Corynebacterium poinsettiae* when this group is emended to include motile forms [cf. *R.A.M.*, xxi, p. 364]), the agent of a destructive disease of poinsettia (*Euphorbia pulcherrima*) in New Jersey, New York, Maryland, and Pennsylvania, the most prominent symptoms of which are longitudinal, water-soaked, generally unilateral streaks on the green stems, sometimes continuing upwards into the petioles and leaves and resulting in spotting or blotching and total defoliation, and downwards into the woody stem, inducing cortical yellowing and a brown discoloration of the vascular system. At an advanced stage of infection the stems rupture and bend sharply down towards the unaffected side. Cuttings from affected plants do not develop normally, and in one greenhouse both they and the stocks from which they originated were a complete loss. The causal organism was isolated in pure culture from diseased plants and inoculated into healthy ones with positive results, recovery of the pathogen being effected. Positive results were also obtained by W. H. Burkholder with two of the isolates. Control measures have not yet been fully worked out, but in the meantime the writers advocate the rejection of propagating material, even when apparently healthy, from stocks known to harbour the bacterium, the isolation of rooted cuttings and young plants of sound origin from those of doubtful sources, and the restriction of overhead watering and syringing to avoid the spread of infection.

The cultural characters of *P. poinsettiae* on a number of standard media are described. The non-acid-fast organism is highly pleomorphic, occurring as straight rods, comma-shaped, curved, coccoid, clavate, wedge-shaped, and bizarre involution forms, singly or in palisade arrangement; capsules are formed in some sugar-containing media; motility is effected by one polar or lateral flagellum, biflagellate forms being rare; the dimensions range from 0·5 to 8·5 by 0·2 to 0·8 (average 1 to 3 by 0·3 to 0·6)μ; the initial Gram-positive reaction changes into a variable response to Hucker's modification of the Gram stain; litmus milk is rapidly peptonized a week or two after inoculation and blood serum liquefied in three to ten days. On tryptose phosphate broth growth occurred between 15° and 36° C. after 24 hours and from 7° to 12° after 48, but none was made at the end of a week between 0·5° and 5° or 37° and 50°. Acid was produced in moderate to abundant quantities from glucose, fructose, mannose, galactose, sucrose, maltose, cellobiose, melibiose, raffinose, glycerol, erythritol, salicin, and amygdalin, and in smaller amounts from arabinose, xylose, and lactose; starch was hydrolysed in 11 days and gelatine liquefied in three at 23°.

Report of the Committee on Post-war Agricultural Education in England and Wales. —H.M. Stationery Office, London, 92 pp., 1943, 1s. 6d.

This report of the Luxmoore Committee contains proposals for the reorganization of agricultural education under a National Council responsible for, *inter alia*, the advisory service in plant pathology. Six advisory provinces are proposed instead of the present 13.

Service and regulatory announcements July–September 1942.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 152, p. 65, 1942.

Under Proclamation No. 34 (29th June, 1942), the importation into Jamaica of cotton or any other plant of the species *Gossypium* or a variety thereof is admissible only under a permit from the Director of Agriculture. No consignment of cotton seed may exceed 1 ton in weight. All cotton seed imported into the Island shall immediately be fumigated and before planting shall be immersed for not less than three minutes in concentrated sulphuric acid or disinfected with an approved fungicide.

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW

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Severin (H. H. P.) & Dickson (R. C.). **Perennial-Delphinium ring spot.**—*Hilgardia*, xiv, 8, pp. 465–483, 4 pl., 4 figs., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 276, 1943.]

The host range of an undescribed ring-spot virus of perennial *Delphinium*, as determined by mechanical inoculation experiments, includes 11 species of plants in eight genera belonging to five families, viz., the Blackmore and Langdon *Delphinium* varieties, Turban and Persian buttercups (*Ranunculus asiaticus*), sugar beet, Acala cotton, Turkish and White Burley tobacco, *Nicotiana glutinosa*, *N. alata* var. *grandiflora*, *N. rustica* var. *humilis*, *Petunia hybrida* Crimson King, *Datura stramonium*, and White Spine cucumber. Infection is systemic in the cases of *Delphinium*, cotton, *P. hybrida*, *N. alata* var. *grandiflora*, and cucumber, and local in those of the other hosts, except *R. asiaticus*, a symptomless carrier; the virus was recovered from *Delphinium*, *R. asiaticus*, cotton, tobacco (only during the development of the lesions), *P. hybrida*, and cucumber. The virus was inactivated in ten minutes at 65° C., or after exposure of the extracted juice from cucumber at room temperature for five days; the tolerance to dilution of extracted juice from *Delphinium* and cucumber was 1 in 1,000.

Buchholtz (W. F.). **Influence of cultural factors on Alfalfa seedling infection by Pythium de Baryanum Hesse.**—*Res. Bull. Iowa agric. Exp. Sta.* 296, 24 pp., 3 figs., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 277, 1943.]

Infection of lucerne by *Pythium de Baryanum*, resulting in necrosis of the germinating seed or seedlings, primary and secondary root-girdling and root-tip necrosis, with consequent retardation of growth, tended to be more prevalent in acid ($P_H < 6{\cdot}6$) than in neutral ($P_H > 6{\cdot}6$), although during the hot, dry summer of 1934, some acid soils in different parts of the State were apparently free from the pathogen. Lime, ineffectual against the fungus in laboratory experiments, produced small seedling-stand increases in the field in 1935 and still smaller ones in 1937 and 1938. Both in laboratory and field plantings seed treated with ethyl mercuric phosphate remained healthy in 1935. *P. de Baryanum* seemed to be present in greater profusion in the upper soil layers than at a depth exceeding 4 in. Deep ploughing, by turning up comparatively uninfested soil for the seed-bed, resulted in heavier seedling stands. Red, alsike, and white Dutch clovers [*Trifolium pratense*, *T. hybridum*, and *T. repens*] showed more resistance to *P. de Baryanum* in greenhouse and field plantings than lucerne. Early planting, liming [*R.A.M.*, xix, p. 328], and deep ploughing are recommended as possible control measures.

Koepper (J. M.). **Relative resistance of Alfalfa species and varieties to rust caused by Uromyces striatus.**—*Phytopathology*, xxxii, 12, pp. 1048–1057, 4 figs., 1942.

Lucerne rust (*Uromyces striatus*), normally regarded as one of the minor diseases, has been responsible for considerable damage of recent years, especially to the

seed crop, in parts of the central United States. At the Kansas Agricultural Experiment Station in 1940, a study of the relative resistance to the pathogen of *Medicago ruthenica*, *M. falcata*, and lucerne varieties and selections, was carried out under laboratory, greenhouse, and field conditions. In the laboratory, excised leaves, inoculated by means of a camel-hair brush with fresh uredospores, survived for three to four weeks in moist Petri dishes. In the greenhouse, uredospore suspensions were atomized on to potted plants in moist chambers, in which the relative humidity was maintained at nearly 100 per cent. for 48 hours, whereupon the plants were transferred to wet sand beds on the floor. Under greenhouse conditions *M. ruthenica* was the most resistant, and Turkestan and Hairy Peruvian the most susceptible, of the species and varieties tested. Semipalatinsk immediately followed *M. ruthenica* in resistance to *U. striatus*, while a field selection of Ladak was the most satisfactory representative of the *M. sativa* group in this respect, besides withstanding the attacks of *Ascochyta imperfecta*. Apart from Hairy Peruvian, which was fairly free from rust in the field in 1939, the laboratory and greenhouse ratings of the different varieties agreed very closely with those made out-of-doors.

WERNHAM (C. C.). **Epichloe typhina on imported Fescue seed.**—*Phytopathology*, xxxii, 12, p. 1093, 1942.

Of 104 selections of *Festuca rubra* [var.] *genuina* imported from Hungary in 1939 and grown at the Pennsylvania State College, 27 clones were observed in 1942 (their second season of seed production) to bear the fructifications of *Epichloe typhina* [*R.A.M.*, xxii, p. 139], reported by Miss Sampson and J. H. Western [ibid., xx, p. 471] to be transmissible through the seed to the extent of 99 per cent. In a few clones every seed stalk showed the typical symptoms of 'choke' disease, white stromata being present on the leaf sheaths and on some of the spikelets of the panicle, which often failed to emerge. In view of the risk of widespread systemic infection from this source, the diseased clones were removed from the nursery and burnt, a few severely attacked plants, however, being transferred to an isolated plot and interplanted with a healthy strain to determine the rate of dissemination of the pathogen in the field. Seed from the infected individuals was collected for the study of transmission through this channel and the effect on the fungus of hot-water treatment of the seed, but conclusive evidence from the observations is not to be expected for three years.

CUMMINS (G. B.). **Revisionary studies in the tropical American rusts of Panicum, Paspalum and Setaria.**—*Mycologia*, xxxiv, 6, pp. 669–695, 24 figs., 1942.

On the basis of a taxonomic study of 14 rusts occurring on grasses in the tropical and subtropical regions of North and South America, the author gives an annotated list of these species with revised descriptions and synonymy.

THORNE (D. W.), LAWS (W. D.), & WALLACE (A.). **Zinc relationships of some Utah soils.**—*Soil Sci.*, liv, 6, pp. 463–468, 1942.

Zinc-deficiency symptoms, expressed by the condition commonly known as little leaf or rosette, have been found to be prevalent in Utah on sweet cherries, apricots, peaches, apples, and plums, which have responded favourably to injections and sprays containing zinc salts. The trouble is usually observed on non-calcareous soils derived principally from granite, gneiss, quartzite, or related rocks, and is absent from those originating mainly from limestone. The zinc content of calcareous rocks was ascertained to be almost twice that of non-calcareous, in which, moreover, the element was more soluble than in the limestone, suggesting a comparatively rapid loss during weathering processes. The total available zinc contents of the zinc-deficient and zinc-sufficient areas within the

non-calcareous range top soil and upper and lower subsurfaces) were 5·9, 2·6, and 2·6 p.p.m., and 6·03, 3·40, and 4·03 p.p.m., respectively, the corresponding figures for the calcareous soils being 12·4, 10·4, and 10·5 p.p.m., respectively.

THURSTON (H. W.) & WORTHLEY (H. N.). **Sulphur and copper sprays in relation to Apple-tree growth and yield.**—*Phytopathology*, xxxiii, 1, pp. 56–60, 2 graphs, 1943.

Following up the investigations of Folsom and Christopher on the effects of fungicidal treatments on the growth and yield of apple trees [*R.A.M.*, xxi, p. 530], the writers report the results of trials carried out at the Pennsylvania Agricultural Experiment Station from 1934 to 1941 on Staymans planted in 1929. In the first year all the trees were given a single application of sulphur and lead arsenate at petal fall; in 1935 they were sprayed twice, at the pink stage, and petal fall; and from 1936 onwards a differential programme was followed, one lot being treated according to the standard sulphur-lead arsenate schedule and the other with copper phosphate-lime bentonite-lead arsenate (4-8-4-3-100); the copper phosphate was replaced in 1940 and 1941 by copper zeolite. As far as any definite conclusion can be drawn from the experimental data it may be inferred that the fungicidal treatments, by increasing the size of the crop, gradually slow down the annual girth increments. On the other hand, the sprayed trees held their crops until maturity, whereas those of the controls were largely lost through scab [*Venturia inaequalis*], the incidence of which amounted to 100 per cent. in 1937 and was only slightly lower in 1939 and 1940. Spraying can therefore hardly be implicated as a factor in the failure of orchards to yield profitable harvests.

McCOLLOCH (L. P.). **An apple rot fungus morphologically related to a human pathogen.**—*Phytopathology*, xxxii, 12, pp. 1094–1095, 1942.

Since 1937 at the Bureau of Plant Industry Station, Beltsville, Maryland, the writer has studied 130 highly variable monospore isolates of the apple rot fungus referred to *Sporotrichum malorum* with a view to the determination of the taxonomic position of the pathogen and its relationship to *S. carpogenum* [*R.A.M.*, xi, p. 309]. A preliminary comparison of the experimental material (obtained from decaying fruits, cankerous apple wood, and surface soil below the trees) with a subculture of *S. malorum* from the Bureau voor Schimmelcultures indicated that the original classification by Kidd and Beaumont [ibid., iv, p. 174] was erroneous. In the first place, the dark pigment present in the hyphae, and to some extent in the spores, points to the accommodation of the species among the Dematiaceae rather than the Moniliaceae. Secondly, the sporulation process is characterized by a continuous proliferation of the sporogenous cells, forming conidia, united in mucous masses, through a collar-like apex, a feature which excludes the organism from the form-genus *Sporotrichum*. It is therefore transferred to *Phialophora* as *P. malorum* (Kidd & Beaumont) comb. nov., *S. carpogenum* being considered merely a strain of that species.

Notwithstanding the morphological similarities between *P. malorum* and *P. verrucosa*, the type species of the genus and the agent of chromoblastomycosis in man [ibid., xx, p. 16 *et passim*], there is no evidence of any relationship between the diseases caused by the two species. Apples inoculated with *P. verrucosa* remained sound, the fungus neither growing nor inducing any disintegration of the tissues even under semi-saprophytic conditions.

ISAAC (W. E.). **The storage disorders in some Apple varieties.**—*Fmg S. Afr.*, xvii, 201, pp. 775–780, 806, 5 figs., 1942.

Four years' tests (carried out at the Low Temperature Research Laboratory, Cape Town) of the storage behaviour of Golden Delicious, Granny Smith,

Ohenimuri, Red Delicious, Rome Beauty, Wemmershoek, White Winter, Pearmain, York Imperial, and Winter Red apples (kept for a week at 65° or 68° F. following removal from store) showed that soft scald [*R.A.M.*, xxii, p. 30] affected Rome Beauty alone to any significant extent, when this variety was stored at 29°, at which temperature it showed 18 per cent. soft scald.

'Breakdown' was not a major disorder except in Winter Red. It arose (1) from severe bruising (Red Delicious, Rome Beauty, Winter Red), (2) following water core [ibid., xix, pp. 290, 353], (3) from excessively cold storage (Rome Beauty, 29°), and (4) senescence. The evidence indicated that although susceptibility increases with increasing storage temperature, the breakdown mostly, if not entirely, results from bad bruises, water core, and senescence.

The greatest amount of storage pit (bitter pit developing in storage) [ibid., xx, p. 474] was shown by Red Delicious. When little storage pit was present, its occurrence in relation to temperature and length of storage was erratic. When a larger number of apples was affected, pitting was more prevalent at higher than at lower temperatures, though considerable irregularities in incidence were met with. The relationship was more marked immediately on withdrawal from store than after the apples had been kept for a few days at a higher temperature; it was also more marked during the earlier months of storage than during the late ones. These observations suggest that while storage temperature may have some effect on the number of apples that develop the trouble, lowering the storage temperature as a rule only serves to delay the onset of an inherent disorder.

Core flush [ibid., xviii, p. 187] was observed in Granny Smith, Ohenimuri, and Red Delicious. It develops at higher rather than lower storage temperatures, but during six months' storage it did not occur in Ohenimuri at 29° or 32°. At higher temperatures, however, this variety was particularly susceptible, both as regards intensity in individual apples, and number affected. Its relation to storage temperature was more erratic in Granny Smith apples, which are less severely affected than Ohenimuri.

Superficial scald, affecting the skin only or at most only a few mm. of the flesh, may develop as more or less circular areas, centring round the lenticels and measuring from under 1 to over 5 mm. in diameter. Diameters of intermediate size are generally noted (Rome Beauty, Pearmain). It may occur as diffuse or irregular patches. Continuously scalded areas may (Granny Smith) or may not be (Ohenimuri, Winter Red) slightly depressed. The affected areas vary from dirty grey and dirty green through light and medium- to dark brown. The appearance of the condition depends partly on length of storage and partly on the variety. Granny Smith apples develop two kinds of superficial scald, at lower and higher storage temperatures, respectively. One apple may show more than one kind of superficial scald, as is often observed on Rome Beauty.

Superficial scald is a widespread storage disorder of South African apples. In the varieties tested it occurred chiefly at two temperature ranges, 29° to 33° and 37° to 45°, the former type affecting Granny Smith, Red Delicious, and Wemmershoek, and the latter Granny Smith, Winter Red, Ohenimuri, and Pearmain. The superficial scald of Granny Smith developing at the higher storage temperatures is less severe and appears later in storage life than the form that develops at the lower temperature. Apples subject to the higher temperature form of superficial scald should be stored at temperatures under 35°, particularly Ohenimuri, which stores well at 32°, but may develop considerable superficial scald at 35° or above. Apples subject to the lower temperature form should not be stored at temperatures under 35° or over 37°.

Oiled paper wrappers are especially effective against superficial scald when the apples are stored at temperatures other than the optimum for the development of the scald concerned. They gave best results with Red Delicious, Wemmershoek,

and Pearmain, and were least satisfactory with Ohenimuri. Even where they failed to reduce the number of apples affected, they mitigated the intensity of the condition in the individual apples.

The consignments of Golden Delicious and York Imperial kept in storage did not develop superficial scald. With Rome Beauty the incidence of superficial scald in relation to storage temperature varies from season to season and district to district. It is apt to develop considerable superficial scald at all temperatures, but as a rule is more severely affected at higher than at lower storage temperatures. Except at the temperature most favourable to the disorder, however, the use of oiled wrappers entirely eliminates or substantially reduces the condition in this variety.

It is concluded that Golden Delicious, Ohenimuri, White Winter Pearmain, York Imperial, and Winter Red should be stored at about 32°, and Granny Smith, Red Delicious, and Wemmershoek at about 35° to 36°. Oiled wrappers should be used except with Golden Delicious and York Imperial, while Rome Beauty should, on the whole, do best at over 30° and below 35°, in oiled wrappers.

PALMITER (D. H.) & HAMILTON (J. M.). **'Fermate' new Du Pont fungicide.**—*Agric. News Lett.*, x, 3, pp. 57–58, 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 281, 1943.]

The most promising of the many organic compounds which have been tested as substitutes for sulphur in the control of fruit diseases is stated to be ferric dimethyl dithiocarbamate (F–D–D–C) [*R.A.M.*, xxi, p. 506], which effected absolute elimination of apple rust [*Gymnosporangium* (?) *juniperi-virginianae*], whereas sulphur reduced foliar infection by only 50 per cent. Applied to sweet cherries just before harvest at the rate of ½ lb. per 100 gals. water plus a spreader of ½ pint cottonseed oil, F–D–D–C protected the fruit from decay [due to *Coccomyces hiemalis*] for several days without leaving any perceptible deposit.

KIENHOLZ (J. R.). **Boron deficiency in Pear trees.**—*Phytopathology*, xxxii, 12, pp. 1082–1086, 1 fig., 1942.

Applications of borax to the soil surrounding Bartlett and Bosc pears at two localities in Oregon in 1940 and 1941, respectively, and at dosages of 12 oz. and 1 lb. per tree, respectively, entirely corrected a condition characterized by the formation of circular to angular, blunt-bottomed, shallow depressions on the fruit surface, especially near the calyx end, superficial dark- or light-coloured bark cankers with slightly raised, uneven borders on the younger branches, and die-back of the twigs, culminating in the death of the tree. Symptoms on the tree may develop without the fruit being affected. The pitting resembles that due to the stony-pit virus [*R.A.M.*, xviii, p. 463], and the two diseases often occur on the same tree. Little doubt is entertained by the writer as to the identity with stony pit of the pear diseases variously designated crinkle, bitter pit, and internal cork in Australasia [ibid., ix, p. 322; xvi, p. 471]. Treatment with borax failed to control black end of Anjou pears [ibid., xvii, p. 693], attributed to uncongenial stock and scion relations.

BLODGETT (E. C.). **Peach wart.**—*Phytopathology*, xxxiii, 1, pp. 21–32, 3 figs., 1943.

Peach wart [*R.A.M.*, xxi, p. 27], first observed in Idaho in 1938 and subsequently located in Washington and Oregon, is characterized by smooth or rough, pale tan to red outgrowths on the fruit tissues, particularly near the stylar end, usually accompanied by gumming, which may be very severe. The virus, which has been provisionally named *Galla verrucae*, is readily transmissible by budding and persists in the tree. Peach is the only known host, the varieties affected being J. H. Hale, Elberta, Candoka, Early Crawford, Halberta, Slappey, July Elberta,

and Seedlings. A slow natural increase of the disease appears to take place. Control should be based on the eradication of diseased trees and the use of sound wood for propagation.

HILDEBRAND (E. M.) & PALMITER (D. H.). **Control of X disease of Peaches by killing Chokecherry weed with ammonium sulfamate.**—*Agric. News Lett.*, x, 3, pp. 73–75, 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 279, 1943.]

The virus of 'X' disease of peach, also known as yellow-red virosis, may spread from *Prunus virginiana*, its wild host, to orchards at a distance of 200 ft. For the destruction of shrubs or fence-row weeds of chokecherry ammonium sulphamate proved equal or superior to sodium chlorate. For shrubs ranging up to 4 ft., a spray consisting of $\frac{3}{4}$ lb. in 1 gal. water suffices to cover 100 sq. ft.

RASMUSSEN (E. J.) & CATION (D.). **A progress report on the yellow-leaf disease of sour Cherry.**—*Rep. Mich. hort. Soc.*, lxxi, pp. 100–105, 1941. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 2, p. 215, 1943.]

The slowly-acting virus responsible for yellow leaf [yellows] of sour cherries [*R.A.M.*, xxi, p. 442], present in Michigan for at least 20 years, is of economic importance as the cause of premature defoliation, progressive reduction in spur growth, decline in yields, and curtailment of the profitable life of the orchard. The disease does not respond to treatment by means of sprays, fertilizers, or cultural practices. The virus is transmissible by budding, but the mode of orchard dissemination has not been established, though there is some evidence that leafhoppers may act as vectors. Montmorency selections appear to vary in susceptibility. The propagation of nursery trees from healthy, high-yielding strains or selections is likely to become an important control measure.

DEMAREE (J. B.) & WILCOX (MARGUERITE S.). **Blueberry cane canker.**—*Phytopathology*, xxxii, 12, pp. 1068–1075, 3 figs., 1942.

A technical diagnosis is given of *Physalospora corticis* n. sp., the agent of a stem and shoot canker of considerable economic importance in the cultivated high-bush swamp and rabbit-eye blueberries (*Vaccinium australe* and *V. ashei*) plantings of Alabama, Florida, Georgia, Mississippi, and North Carolina, to which it is believed to have spread from wild plants of the same species in Florida and North Carolina. Cabot is the most susceptible of the high-bush blueberries, followed in descending order by Pioneer, Concord, June, Stanley, Jersey, Scammell, Rancocas, and Jubel, while Locke is the only one of the rabbit-eyes so far examined to show natural cankers.

The pathogen gains admission through the unbroken bark, probably by way of the lenticels of current-year shoots, the sites of entrance becoming apparent in the late summer or early autumn as reddish, broadly conical swellings, on the surface of which develop the black, conical to subglobose, ostiolate pycnidia, 90 to 208 μ high and 60 to 165 μ wide (mostly 105 to 140 by 70 to 100 μ), with carbonaceous walls, 10 to 30 μ in thickness. In the case of the susceptible Cabot and Pioneer varieties, the protuberances lose their reddish colour and conical shape during the second year after infection, when they begin to expand and develop fissures. The fungus invades the cortical tissues in all directions from the site of infection, the newly invaded bark swelling and its surface becoming blistered and turning pale grey. Besides the cortex and cambium, the xylem is also slightly penetrated with a certain amount of discoloration but no extensive necrosis. By the end of the second year of the attack or the beginning of the third, the older portions of the cankers are rough, black, and deeply fissured, the parts above the girdled shoots becoming unfruitful and finally dying. The cankers invariably make their first appearance on the side of the shoots directly exposed to the sun's rays.

The fusiform-elliptical, simple, hyaline pycnospores, 35 by 9 μ, arise from conidiophores 15 μ in length. Another type of spore, occasionally observed either in the pycnidia or in somewhat smaller fruiting bodies, is rod-shaped, hyaline, 3 to 7 μ in length, and develops from relatively long conidiophores: this presumably constitutes a stage in the life-history of the fungus, being produced on maize meal cultures in flasks inoculated with the green, septate, coarse, sparsely branched mycelium from subcultures derived from ascospores, which are hyaline or slightly tinted, ellipsoid to fusoid, non-septate, 29·2 by 11·7 μ, and germinate rapidly, forming unbranched hyphae reaching a length of 142 to 380 μ in 19 hours. The perithecia of *P. corticis* are produced in much greater abundance than the pycnidia, which they superficially resemble apart from their pointed ostioles, sometimes elongated into beaks 50 to 100 μ in length. The clavate, eight-spored asci, very thick-walled at the apex, develop from the base of the perithecium, which seldom contains more than twelve and often only four to eight, and push their way upwards through a mass of white, erect, closely packed, short-celled, anastomosing hyphae, regarded by Shear *et al.* in their studies of *Botryosphaeria ribis* and *Physalospora obtusa* as a form of paraphyses [*R.A.M.*, iv, p. 178]. In some respects *P. corticis* is similar to *P. obtusa*, from which it differs, however, in the shape and colour of its pycnospores, its rate of growth in culture, its profuse perithecial development (the pycnidial stage being the more abundant in *P. obtusa*), and its failure to cause decay in apples.

The results of inoculation experiments afforded ample proof of the pathogenicity of *P. corticis*, especially on injured shoots. The most promising lines of approach to the control problem are the planting of disease-free plants and the use of resistant varieties.

VIÉGAS (A. P.). **Notas sobre Polyporus sapurema Möller.** [Notes on *Polyporus sapurema* Möller.]—*Rodriguésia*, vi, 15, pp. 57–60, 24 figs., 1942.

Particulars are given of the writer's morphological, cultural, and cytological studies on *Polyporus sapurema* [*R.A.M.*, xvii, 192], immense sclerotia of which, weighing over 50 kg. each, were collected in 1938 in a new banana planting near the Ubatuba Experiment Station, Brazil. Pure cultures were obtained from fragments of tissue from the stipe and context, as well as from basidiospores *en masse*. On plain potato agar the mycelium is white, while the presence of gallic or tannic acid causes the development of an ashen-grey halo. The basidia of the fungus are binucleate and claviform, each bearing four basidiospores.

MULLER (H. R. A.). **Overzicht van de belangrijkste Mangga-ziekten in Nederlandsch Indië.** [Survey of the principal Mango diseases in the Dutch East Indies.]—*Meded. alg. Proefst. Landb., Batavia*, 40, 9 pp., 1940. [English summary.]

Gloeosporium mangiferae is the most important pathogen of mangoes in the Dutch East Indies, attacking seedlings and nursery plants and the leaves, twigs, inflorescences, and fruits of older trees. Regular spraying with 1·5 per cent. Bordeaux mixture arrests the spread of infection. Damping-off (*Rhizoctonia* [*Corticium*] *solani*) is another disease of seedlings which may be combated by two soil treatments with ceresan applied at a dosage of 5 l. of a 1 in 5,000 solution per sq. m. ten days before sowing and again two days later after the soil has been thoroughly turned over to a depth of 20 cm., followed during the growing season by weekly spraying of the plants and soil with 1·5 per cent. Bordeaux. The bark canker caused by a species of *Physalospora* was very destructive to trees of 10 to 12 years old or younger at one locality in the Madoera district. The diseased areas should be excised and the wounds painted with a mixture of 92 per cent. hard paraffin wax and 8 per cent. carbolineum plantarium, a similar treatment being applicable

to the stems of trees invaded by *Botryodiplodia theobromae* as a sequel to injury by sun scorch, tar, or tangle-foot.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Scab of Mango caused by Elsinoë.**—Abs. in *Phytopathology*, xxxiii, 1, p. 1, 1943.

A species of *Elsinoe* resembling *E. fawcetti* but regarded as new [though not named] has been observed to cause the formation on mango leaves, stems, and fruits of lesions varying in colour and shape according to the age of the host and the country in which the scab occurs. On nursery plants at Santiago de las Vegas, Cuba, for instance, the spots are pale to brown and covered with a delicate buff down, representing the conidial stage of the fungus, and induce the crinkling and shedding of severely infected leaves, while the somewhat larger lesions on the older foliage are grey above, surrounded by a dark margin, and bear the small, nearly black ascomata of the perfect stage of the pathogen. In São Paulo, Brazil, the spots are circular to elongated or irregular, with a grey centre and dark periphery, following the midrib or disposed in proximity to it. Lesions of both the foregoing types have been observed at Manaos, Amazonas, Brazil, and in Puerto Rico, the Canal Zone, and Florida. A monoconidial culture was isolated from a Cuban sample and a tissue culture from Florida.

RUDOLPH (A. S.). **Some factors affecting the germicidal efficiency of hypochlorite solutions.**—*Iowa St. Coll. J. Sci.*, xvii, 1, pp. 114–116, 1942.

The author gives the results obtained in a study of the germicidal activity of the calcium hypochlorite (B–K) solutions tested at various concentrations, P_H reaction, and temperature, against *Bacillus metiens* at 20° C. P_H reaction was found to be a much more important factor in disinfection with hypochlorites than is the concentration of available chlorine.

IARI collection of fungi.—*Indian Fmg*, iii, 10, p. 548, 1942.

The Imperial Agricultural Research Institute is continuing its efforts, initiated before the outbreak of war, to organize a collection of typical fungus cultures for supplying workers in this field free of cost throughout India. Only a few hundred are at present available, and it is hoped that mycologists in different parts of the country will co-operate in the expansion of the collection by sending cultures to the Imperial Mycologist at the Institute, New Delhi.

MARTYN (E. B.). **Diseases of plants in Jamaica.**—*Bull. Dep. Sci. Agric. Jamaica* 32, 34 pp., 1942.

This bulletin falls into six parts, of which (1) deals with the types and symptoms of plant diseases; (2) with control methods, comprising cultural measures, the use of resistant varieties, and fungicidal treatments; (3) with some common groups of maladies, namely, virus diseases, root and collar rots, leaf spots, fruit rots, and anthracnoses; (4) describes some important diseases of the major crops cultivated on the island, namely, banana, citrus, coco-nut, and sugar-cane; (5) is concerned with the disorders of the minor crops, cacao, cassava, cocoes [*Xanthosoma*], coffee, maize, ginger, groundnut, pimento, potato, soy-bean, sweet potato, tobacco, tomato, and yams; and (6) treats of the diseases of garden crops (vegetables, fruits, and ornamentals).

DRECHSLER (C.). **Antagonism and parasitism among some Oomycetes associated with root rot.**—*J. Wash. Acad. Sci.*, xxxiii, 1, pp. 21–28, 3 figs., 1943.

In a cultural study of fungi associated with root rots of herbaceous cultivated plants, it was found that certain species of *Pythium*, e.g., *P. oligandrum*, *P. acanthicum*, and *P. periplocum*, are antagonistic to other members of their genus.

Thus, in dual cultures on soft maize meal agar (preferably one containing not more than 15 gm. of agar per l. and incubated at 28° C.), *P. oligandrum* vigorously attacked *P. ultimum* by enveloping the hyphae of the latter with its own intricately ramified hyphal branches, penetrating the enveloped hyphae of the victim and extending longitudinally within them to assimilate the degenerating protoplasmic contents. The destructive activity was highest in the narrow zone where young, vigorous hyphae of the aggressor came upon equally young hyphae of the victim. Conidia and young oogonia of *P. ultimum* were also attacked, but apparently less readily. The destruction was often so rapid and thorough that sexual reproduction of *P. ultimum* was only rarely permitted to reach a stage where the thick oospore wall affords reliable protection. *P. de Baryanum* and *P. irregulare* were also violently attacked by *P. oligandrum*, both in dual cultures and in isolation plate cultures on natural substrata such as tomato and pansy roots, and sugar beet and peach seedlings. Other species attacked by *P. oligandrum* were *P. mamillatum*, an undescribed *ultimum*-like species associated with pansy root rot in Columbia, *P. splendens*, *P. salpingophorum*, and to a lesser degree *P. butleri*, *P. graminicola*, *P. arrhenomanes*, *P. helicoides*, *P. oedochilum*, and *P. palingenes*. Similarly, *P. acanthicum* and *P. periplocum* could be observed in dual cultures to attack all the above-mentioned species with the same degree of severity as *P. oligandrum*, and in addition they readily attacked *P. marsipium*, indicating that aquatic congeners are not excluded from their destructive parasitism.

The three species thus observed to attack other members of their genus were all characterized by an abundant, delicate mycelium, the slender hyphae arising laterally from axial filaments of moderate width. All three species initiate and conclude sexual reproduction earlier than most congeneric forms. Coarse species, such as *P. megalacanthum* de Bary *sensu* Buisman, *P. mastophorum*, *P. polymastum*, and *P. anandrum* were readily attacked by all three delicate species, though with varying degrees of severity. *Pythiogeton autossytum* was attacked only feebly by *Pythium oligandrum* and severely by the other two.

In turn, *P. oligandrum* proved liable to attacks from a number of Oomycetes, e.g., *P. complens* and, in a very severe manner, *Plectospira myriandra*, the latter also attacking the other two aggressive species as well as a number of other congeneric fungi. Moreover, three strains of *Aphanomyces* from flax, spinach, and pansy, all referred to *A. cladogamus*, proved capable of attacking numerous species of *Pythium*, e.g., the spinach strain attacked *P. undulatum* and that from pansy *P. dissotocum*. A weak antagonism was also displayed by *A. cochlioides* against *P. de Baryanum*, *P. mamillatum*, and *P. myriotylum*. It is believed that both *A. cladogamus* and *A. cochlioides* are direct parasites on the phanerogamic plants on which they occur habitually; on the other hand, the spiny *A. exoparasiticus* may not be parasitic on phanerogams, as the several Saprolegniaceous fungi hitherto found attacking higher plants all had smooth oogonia. Both *P. periplocum* and *P. acanthicum* are believed to be direct parasites on watermelon. It is concluded that a capacity for causing disease in higher plants can coexist, in the Oomycetes under consideration, with a capacity for attacking and injuring other members of the ecological assemblage, the antagonistic relationship being apparently strongest where both fungi concerned are in a high state of vegetative vigour.

Martin (W. J.). **A simple technique for isolating spores of various fungi from exposed slides in aerobiological work.**—*Phytopathology*, xxxiii, 1, pp. 75–76, 1943.

The following method has been found to assist in the difficult problem of identification on exposed slides of the wind-borne spores of various plant pathogens and certain organisms responsible for allergic conditions in man. Under the low power

of the microscope, the position of a spore or spore group is marked with a crow-quill pen and India ink on the slide, which is then inverted over a Van Tieghem cell and single spores isolated by means of a micromanipulator, as described by Hanna [*R.A.M.*, viii, p. 323]. The manner of spore formation, an important feature in fungal determination, can thus be followed in the case of any spores germinating and giving rise to sporulating cultures. Thus, the ovoid, brown spores, 5 to 9 μ in diameter, present in thousands on vaseline-coated slides (3 sq. in.), which germinated after isolation in the above manner and produced promycelia with hyphal branches, were referred on this basis to one of the loose smuts, *Ustilago nuda* or *U. tritici*, and subsequently the same technique was successfully applied to a number of organisms, e.g., *Penicillium*, *Aspergillus*, *Trichoderma*, *Cephalosporium*, *Fusarium*, *Cladosporium*, *Rhizopus*, and *Pleospora*: none of these could have been reliably identified by the study of their somewhat nondescript morphological characters alone. Smut and *Fusarium* spores on exposed slides were found to be viable after three months and one month, respectively.

Markham (R.), Smith (K. M.), & Lea (D.). **The sizes of viruses and the methods employed in their estimation.**—*Parasitology*, xxxiv, 3–4, pp. 315–352, 1942.

An account is given of the known methods of measuring the size of virus particles, i.e., ultra-violet light and electron microscopy, X-ray diffraction, sedimentation and diffusion, filtration, and radiation inactivation. Published data on the sizes of animal and plant viruses and bacteriophages are summarized. Only in the cases of three viruses, tobacco mosaic, tomato bushy stunt, and vaccinia are the data thought sufficiently adequate to be able to state the size and shape and molecular weight of these viruses. It is suggested that in order to obtain precise data on the size of a virus, it should be studied in as purified a form as possible. It is thought desirable to apply several different methods of measurement before an estimate of size can be given with some confidence. A bibliography of 193 titles is appended.

Robbins (W. J.) & Ma (Roberta). **Vitamin deficiencies of Ceratostomella and related fungi.**—*Amer. J. Bot.*, xxix, 10, pp. 835–843, 3 figs., 1942.

Continuing their earlier studies [*R.A.M.*, xxi, pp. 12, 468; xxii, p. 104], the authors grew 13 species of *Ceratostomella* and related fungi, viz., *Ophiostoma catonianum*, *C. multiannulata*, *C. obscura*, *C. pilifera*, *C. pluriannulata*, *C. stenoceras*, *C. microspora*, *C. penicillata*, *Grosmannia serpens*, *C.* (*G.*) *rostrocylindrica*, *Endoconidiophora* [*C.*] *paradoxa*, *E.* [*C.*] *coerulescens*, and *E.* [*C.*] *adiposa*, in a mineral-dextrose medium containing asparagin, and in the same medium supplemented with thiamin, pyridoxin, or biotin, singly and in combination, or with malt extract.

Eleven of the species showed complete or partial deficiencies for one or more of the three vitamins, viz., *O. catonianum*, *C. obscura*, *C. pilifera*, *C. multiannulata*, *C. stenoceras*, *C. pluriannulata*, *C. penicillata*, *C. microspora*, *G. serpens*, *C. paradoxa*, and *C. coerulescens*. Complete or almost complete deficiency for pyridoxin was shown by *O. catonianum*, *C. pilifera*, *C. multiannulata*, *C. pluriannulata*, *C. penicillata*, and *C. microspora*, for thiamin by *C. obscura*, *C. stenoceras*, *C. penicillata*, *C. microspora*, and *C. paradoxa*, and for biotin by *C. obscura*, *C. penicillata*, *C. microspora*, and *C. paradoxa*. Six of the fungi, viz., *C. multiannulata*, *C. pluriannulata*, *C. penicillata*, *C. microspora*, *C. obscura*, and *C. rostrocylindrica*, made conspicuously better growth in a medium supplemented with malt than in media supplemented with the three vitamins.

Robbins (W. J.) & Ma (Roberta). **Vitamin deficiencies of twelve fungi.**—*Arch. Biochem., N.Y.*, i, 2, pp. 219–229, 1 fig., 1942.

Nine of the 12 species of fungi grown in a basal mineral-dextrose medium

containing asparagin and supplemented with thiamin, pyridoxin [see preceding abstract], and biotin, singly and in all possible combinations, showed partial or complete deficiencies for one or more of the vitamins. For instance, *Ceratostomella radicicola* [*R.A.M.*, xxi, p. 195] suffered from a total deficiency of thiamin (likewise absent from *C. paradoxa*) and an almost total lack of biotin; a perithecia-producing strain of *C.* sp. from London plane [*Platanus acerifolia*; ibid., xx, p. 610] was altogether destitute of thiamin and partially deficient in pyridoxin; thiamin was entirely absent from *Chalaropsis thielavioides* from lupin and rose [ibid., xxi, p. 19], and *Polystictus versicolor* was almost entirely lacking in thiamin and partially so in pyridoxin. The remaining three species, a strain of *Sclerotinia* from eggplant, *Claviceps purpurea* from rye, and *Stereum murrayii*, did not respond to any of the growth substances but grew better in a medium containing malt than in the basal substratum.

Mujica (F.). **Patogenicidad de algunas cepas del Verticillium albo-atrum Rei. y Berth.** [The pathogenicity of some strains of *Verticillium albo-atrum* Reinke & Berth.]—*Bol. Sanid. veg., Santiago*, i, 2, pp. 7–20, 2 figs., 2 graphs, 1941.

The following tentative conclusions are drawn from the author's small-scale experiments on the comparative pathogenicity of ten strains of *Verticillium albo-atrum* [*R.A.M.*, x, p. 757 *et passim*], of which all but one, originating in Pennsylvania, were isolated from different hosts in various localities of New York State. The strains fell into three groups according to (a) their effects on the Irish Cobbler potato plants (Katahdin having also been tested but found to be immune) into which they were inoculated by the introduction of mycelial fragments or spore suspensions into the stems, infestation of the soil, or immersion of the roots in a spore suspension, and (b) their development in potato dextrose agar cultures. Group (1) consisted of two definitely pathogenic isolates from rose and eggplant, which made vigorous growth in culture; (2) comprised the weakly pathogenic strains from *Koelreuteria paniculata*, *Chrysanthemum* sp., *Acer platanoides*, and elm (*Ulmus americana*), of which the two former developed poorly and the latter abundantly in culture; and (3) was represented by the non-pathogenic isolates from *A. pennsylvanicum*, *Lonicera* sp., *Physalis* sp., and *Platanus* sp., the growth increments of which in culture proceeded regularly. The injurious action of the several strains on their experimental host was directly correlated with their temperature relations in culture, the minimum, optimum, and maximum for growth in this series of trials being determined as 3° to 6°, 18° to 24°, and 27° to 33° C., respectively.

Two of the first symptoms of the wilt induced in the potato plants in these inoculation tests were epinasty of the leaf petioles and the development of dark coffee-coloured spots or stripes on the stems, features believed to be here recorded for the first time in connexion with *Verticillium* wilt of the host in question.

The data here presented are considered to afford cogent evidence for the existence of physiologic specialization in *V. albo-atrum*.

Gorham (R. P.). **Rhamnus alnifolia L'Hér., a winter host of Aphis abbreviata Patch, one of the aphids feeding upon Potato foliage.**—*Canad. Ent.*, lxxiv, 5, p. 96, 1942.

Attention is drawn to the recent detection in Victoria County, New Brunswick, of dense masses of *Aphis abbreviata* Patch [a vector of potato viruses: *R.A.M.*, ix, p. 475] in the oviposition phase (late September to late October) on the leaves and stems of *Rhamnus alnifolia* growing within 500 ft. of a 165-acre field of potatoes which, in the previous August, had sustained exceptionally severe infestation by the aphid. Another winter host plant of *A. abbreviata* in York County is *R. frangula*.

Peters (E. J.). **Stem-end vascular discoloration of Potatoes due to Fusarium oxysporum f. tuberosi.**—*Amer. Potato J.*, xx, 1, pp. 10–12, 1943.

Out of 426 White Rose potato tubers grown in the Stockton Delta, California, in 1941, 380 were found to be infected by *Fusarium oxysporum* f. *tuberosi* [*F. euoxysporum*], while a further 28 of doubtful appearance were referred to W. C. Snyder, who identified the same pathogen as the agent of the characteristic light to dark brown or black stem-end discoloration of the vascular tissues. The 380 diseased tubers were planted in 1942, each being cut into three seed pieces, together with a similar number which gave negative results in respect of fungal contamination on agar cultures. The percentages of healthy plants arising from the diseased and clean tubers were 3·4 and 83·9, respectively, while slight, medium, and heavy discoloration was shown by 12·2, 36·9 and 47·5 per cent., respectively, of the former, and by 10·2, 4·3, and 1·6 per cent., respectively, of the latter. The infected seed yielded 0·8 lb. per hill, equivalent to 201 100-lb. sacks per acre, and the clean 1·3 lb. (326 sacks). Since about 60 per cent. of the diseased tubers would fail to pass U.S. grade specifications, the use of discoloured seed would entail an economic loss of nearly 80 per cent. The pathogen was reisolated from every one of the 696 tubers cultured again, so that its exclusion from foundation seed stocks is clearly desirable.

Potatoes.—*Bull. Me agric. Exp. Sta.* 411–C, pp. 281–343, 8 figs., 1942.

Apart from information already noticed from other sources the following items of interest are contained in this bulletin dealing with potato diseases in Maine. A method of controlling ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxii, p. 37] at small initial expense has been evolved, based on a three-year plan of replanting: in the first year a plot (about $\frac{1}{100}$ of the total potato acreage of a farm) not previously under potatoes should be planted with new, disease-free seed stocks, taking care to disinfect all equipment beforehand; next year stock from this plot should suffice to plant $\frac{1}{10}$ of the total acreage, and the third year should see the entire farm re-planted with sound stock. When an ultra-violet lamp was used by R. Bonde and A. F. Ross for examining tuber samples [ibid., xxii, p. 107], 0·2 to 0·6 per cent. of tubers affected with ring rot escaped detection, as compared with 2 per cent. which were overlooked when no lamp was used. In addition to the results previously reported from disinfectant trials [ibid., xxi, p. 322], copper sulphate (1 lb. in 10 gals. water) was found very effective in killing the ring-rot organism on potato bags.

In continued studies by D. Folsom at Highmoor Farm [ibid., xxi, p. 499] one seedling tested for three years, and 19 tested for two years exhibited considerable resistance to leaf roll and showed some promise for table stock quality. The foundation seed potato programme initiated in 1939 [ibid., xxi, p. 322] is stated to have had a reasonable success. In the Florida test conducted since 1938 with a view to locating any good seed stocks in the State, the average foundation seed stock from Maine was consistently less affected by leaf roll than the average of other seed stocks represented. The results obtained with the various dates of harvesting in 1941 gave ample support for the recommendation for early harvesting as a means of avoiding much of the spread of leaf roll that may occur if vines remain green until normal digging time. The results of two years' fertilizer tests showed that chlorides favoured net necrosis [a symptom of leaf roll: ibid., xix, p. 492]. Potatoes stored at 33° F. for 120 days developed net necrosis in 18 per cent. of the tubers, while others from the same field stored at 47° for the same time showed 40 per cent.; potatoes from another field stored for 154 days showed 15 and 35 per cent., respectively, at the same two temperatures. It was also found that initial storing for 10 to 30 days at 34° reduced net necrosis development in subsequent

storage at 47° and one for 30 to 90 days even entirely stopped it. It is pointed out, however, that although temperatures near 32° or 33° help to control both net necrosis and stem-end browning in Green Mountain potatoes, they may cause the more serious mahogany browning [ibid., xxi, p. 302] in Katahdins, Chippewas, and Sebagos.

Fertilizers containing chloride were found to stimulate the development of stem-end browning [ibid., xxi, p. 322], and the results of all tests indicated that either the sulphate or the nitrate of potash, or a combination of the two, is just as effective a source of potash as the muriate. Potatoes stored at 60° developed 47 per cent. of stem-end browning as compared with 10 per cent. in those stored at 33°. The first 60 days in storage were found to be the most critical for the development of stem-end browning: potatoes stored for 120 days at 33° developed 13 per cent. stem-end browning, while those stored for 60 days at 33° and then at 52° for another 60 days developed only 14 per cent., and those stored for 30 days at 33° and then for 90 days at 52° developed 23 per cent. It is recommended, therefore, to adjust storage temperature for Green Mountains and Cobblers to about 33° as soon as possible after harvesting, while Chippewa, Katahdin, Sebago, and Houma should not be cooled below 36°, as they tend to develop mahogany browning at about freezing point or slightly above.

The purple-top disease [ibid., xvii, p. 480], the cause of which is as yet unknown, is stated still to present a serious problem. It would appear that there are two diseases with symptoms of purple top, one not affecting the seed quality of the tubers and another that does. The disease attacks all varieties, but particularly Katahdins and Sebagos.

The results of the 1941 studies (by R. Bonde and B. Plummer) on the *Rhizoctonia* [*Corticium*] *solani* disease [ibid., xxi, p. 322] indicate that the acid content of the solution used in the acidulated mercury dip method can be safely reduced from 1 per cent. in the standard formula to 0·25 per cent.; also that citric acid may be substituted for hydrochloric or acetic acids, although solutions prepared with acetic or citric acid were somewhat less effective than those acidulated with hydrochloric.

Late blight [*Phytophthora infestans*: ibid., xx, p. 30] is stated to have been very severe in Aroostook County in 1941 causing a loss estimated at about 10 per cent. of the entire crop. In fungicide tests against late and early [*Alternaria solani*] blights, conducted with the Houma variety in 1941 by R. Bonde, plots sprayed seven times a season with copper hydro arsenate and 'copper hydro arsenate-ite' yielded four and five barrels more per acre, respectively, than did those sprayed with Bordeaux mixture. In comparative trials with different concentrations of Bordeaux mixture, early and late blight were controlled equally well by all the formulas tested, viz., 10–10–100, 8–8–100, 8–4–100, and 10–5–100. It is considered that the time of application and the maintenance of a good coverage of spray material at the critical period for late blight are more important, within limits, than the particular formula used.

In experiments conducted during 1941 by R. Bonde and G. W. Simpson for the combined control of diseases and insects, the addition of rotenone, in the form of ground derris root, to copper fungicides (Bordeaux mixtures 10–10–100 and 10–5–100, basicop 5–100, spraycop 6–100, and yellow cuprocide 1·5–100) resulted in an increase in yield of from 9 to 17 barrels of potatoes per acre, but failed, it is thought, to reduce the insect population sufficiently to affect the spread of leaf roll and other virus diseases. A new machine, 'Vapo-duster' (Root Duster Co., Cleveland, Ohio), intended for combined fungicide and insecticide treatment in controlling late blight and insects, was tested with promising results. With this machine, the copper-containing dust is expelled by tractor power with great force through one set of holes on the spray rig and the insecticidal oil mist through

another. The machine seemed to cause less plant injury than an ordinary tractor power sprayer. The lowest yields of potatoes were obtained in plots treated with Bordeaux mixture 10–5–100 (applied with the tractor power sprayer) without an insecticide, while an increase of 16 barrels per acre resulted from the application of a combined red copper oxide dust (6 per cent.), oil, and rotenone-pyrethrum insecticide applied by the Vapo-duster, and one of 14 barrels from the application of combined Bordeaux mixture and rotenone.

STEVENSON (F. J.), FOLSOM (D.), & DYKSTRA (T. P.). **Virus leaf roll resistance in the Potato.**—*Amer. Potato J.*, xx, 1, pp. 1–10, 1943.

Leaf roll has become a serious problem in some of the best potato-growing regions of the United States. In varieties such as Katahdin, Chippewa, and Sebago, the reduction in yield results from the rolling and yellowing of the foliage and dwarfing of the plants, whereas in others, notably Green Mountain, further losses are caused by the development of net necrosis in the tubers [*R.A.M.*, xxi, p. 322]. Before the phenomenally heavy infestation of the aphid vectors of the disease in 1937, the incidence of leaf roll in Maine could be maintained at a minimum level by isolation, roguing, and early harvesting. However, since the extension of the trouble following the 1937 epidemic, and in view of the impracticability of aphid control, it has been necessary to resort to the breeding of resistant varieties, which has been carried out at two stations in Maine (Aroostook and Highmoor Farms) [see preceding abstract] and one in Maryland (Beltsville). Two methods of testing were practised in the earlier trials, tuber-grafting and field exposure, but the former proving too drastic to demonstrate the differences in resistance in the available material, only the latter was used in the later series. Among the reputedly resistant European varieties brought into the States only Triumf has remained free from infection. In 1942, after five years' exposure, this variety was free from leaf roll, which was present in Bevelander, Shamrock, Friso, West Brabander, Noordeling, and Albion to the extent of 32, 32, 57, 40, 72, and 85 per cent., respectively, while of the American varieties (three years), Green Mountain showed 88 to 100 per cent. infection, Chippewa 80, Katahdin 41, and Houma 10. None of 54 South American varieties showed entire freedom from the disease after one year's exposure, and the apparent escape in 1936–7 of seven of the 60 German 'W' selections from true seed supplied by K. O. Müller, Dahlem, proved to be only temporary, none of five tested again remaining free. Of 271 seedlings completely withstanding the epidemic of 1937–8 on the Aroostook Farm, 91 were from President × Katahdin, first grown in 1932, 30 from Katahdin × Earlaine (1934), 76 from 41956 × Katahdin, and 74 from 41956 × Earlaine (both 1935). The same 271 seedlings were planted at Beltsville in 1940, and 24 still remained free from leaf roll in 1941, but in 1942 only two showed no symptoms. In 1938, nearly 60 per cent. of the seedlings of a small progeny of Katahdin selfed from the 1937 tests were healthy compared with only 11 per cent. of Green Mountain.

During the period from 1938 to 1942, 65 crosses were exposed to leaf-roll infection in the field at Monmouth, Maine, ten of which were included for the first time in the latter year, so that their reactions cannot yet be recorded. During 1938 to 1942, of the 5,518 seedlings of 55 crosses exposed to infection, 300 (5·4 per cent.) showed no symptoms in 1942, compared with 90·5 per cent. in the Chippewa controls (in which the incidence of infection in the previous year was only 0·5 per cent., indicating the rigorous nature of the tests). Among the more promising crosses were Kepplestone Kidney × Earlaine and Imperia × Earlaine, and it is hoped that some of these may carry factors for resistance different from those of Katahdin.

While no systematic tests have been carried out to determine the tendency of the tubers to develop net necrosis as a result of the current season's infection by

the leaf-roll virus, observations over a protracted period denote that certain varieties, such as Katahdin, Chippewa, and Sebago very seldom, if ever, contract this malady.

Elmer (O. H.). **The prevention of ring rot in Potato seed stocks.**—*Rep. Kans. St. hort. Soc.*, xlvi, pp. 219–223, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 3, p. 713, 1943.]

Potato yields were greatly increased by ten minutes' immersion of the cut seed pieces in a solution of 6 oz. mercuric chloride per 25 gals. water acidulated with 1 per cent. hydrochloric acid for the control of ring rot [*Corynebacterium sepedonicum*], the results obtained by the application of a similar treatment to whole tubers being less satisfactory. A delay of 12 hours after cutting in the soaking of the seed pieces was found to vitiate the beneficial action of the disinfectant. Satisfactory sterilization of potato bags was effected by dipping them in a solution of 1 qt. formaldehyde per 30 gals. water.

Wager (V. A.). **Controlling late blight in Potatoes.**—*Fmg S. Afr.*, xvii, 201, pp. 793–795, 1 fig., 1942.

Potato late blight (*Phytophthora infestans*) occurs in only a few areas in South Africa, and mainly affects seed potatoes in the highlands of the Transvaal (e.g., at Haenertsburg) and of Natal, in the Mooi River, Donnybrook, and Underberg areas. As a rule, the first crop from imported seed suffers most. The imported seed, mainly from Scotland, reaches South Africa in December or January and the crop matures towards the end of summer. Rainfall figures for Underberg for the past 15 years show that heavy rains can be expected at this period, and under these conditions blight may completely destroy the tops and turn the tubers into a rotten slimy mass. In Natal, late blight infection usually appears after a heavy rainstorm, and is most severe in heavy soils and hollow situations. The disease may originate in patches, one such patch observed being 20 yards long by 10 yards wide, whereas the surrounding plants were green and vigorous. Early blight (*Alternaria solani*) attacks potatoes wherever they are grown in South Africa, and at any season, causing extensive losses.

In a test against blight at Donnybrook, Natal, four rows dusted with copper oxychloride containing 16 per cent. copper, applied with a hand-worked rotary machine, gave 2436 lb., as against 2008 lb. for the controls, this increase being equivalent to 11½ bags of 150 lb. each per acre, or an increased profit of £20. The dust (70 to 80 lb. per acre) treatment cost about £2 per acre. The first application was made towards the end of February, and seven treatments were given in six weeks. During this period, there was over 6 in. of rain, and two hailstorms also occurred.

Growers are advised to make a dust application on the first morning after each rainstorm or as soon as there is a break in the weather. Not more than four or five days should be allowed to pass without applying a treatment. Dusting may be delayed until the first sign of infection is noticed, after which it should be carried out two or three times in one week, if the weather conditions warrant it. In dry weather, one treatment every 10 days or two weeks should suffice. Crops should be dusted five to eight times in the season, at the rate of 5 to 10 lb. per acre per application.

Exner (Beatrice) & Chilton (S. J. P.). **Variation in single basidiospore cultures of Rhizoctonia solani.**—Abs. in *Phytopathology*, xxxiii, 1, p. 3, 1943.

In comparative cultural studies on 395 single basidiospore cultures of *Rhizoctonia* [*Corticium*] *solani* isolated from basidial mats on Lima bean [*Phaseolus lunatus*], potato, and alligator weed stems, up to 29 distinct cultural types, differ-

ing in growth rate, colour, sclerotial size and position, and zonation, were found to occur among the isolates from a single mat. Some form of segregation would thus appear to take place in the process of basidiospore production.

Ryker (T. C.). **Physiologic specialization in Cercospora oryzae.**—*Phytopathology*, xxxiii, 1, pp. 70–74, 1 fig., 1943.

This is an expanded account of the writer's studies at the Louisiana Agricultural Experiment Station on physiologic specialization in *Cercospora oryzae* on rice, a note on which has already appeared [*R.A.M.*, xix, p. 301]. There are now definitely known to be five physiologic races of the fungus, distinguishable by their pathogenicity to the Blue Rose, Blue Rose 41, Fortuna, and Calora varieties, while the addition to the test assortment of Colusa, Zenith, and Delitus resulted in the subdivision of race 1 into five sub-races, of race 2 into three, and of race 3 into six, making a total of 16 pathogenic races among the 36 isolates tested. The varieties Rexora, Nira, Iola, Kameji, and Shoemed proved resistant to all races of *C. oryzae*, while Honduras, Edith, and Carolina Gold were susceptible to most, and Vintula apparently heterozygous for resistance, a few individuals being susceptible. The widely grown Blue Rose variety is susceptible to most of the races known to occur in Louisiana, but a selection from it (41) [ibid., xxii, p. 37] is resistant to the most prevalent race 1. The objectionable weed, southern red rice, is ordinarily resistant to *C. oryzae*, but once it is permitted to gain a foothold through neglect of proper cultural measures, it may contract severe infection owing to the increase of the race 5 to which it is susceptible.

Fawcett (G. L.). **Notas sobre el « carbon » de la Caña de Azúcar.** [Notes on the 'smut' of Sugar-Cane.]—*Circ. Estac. exp. agríc. Tucumán* 114, 3 pp., 1942.

An account is given of the symptoms, mode of infection, and distribution of sugar-cane smut (*Ustilago scitaminea*), first definitely reported from Tucumán, Argentine, in 1940 [*R.A.M.*, xxii, p. 197]. On 17th August, 1942, spores of the smut were placed in five porous porcelain tubes, which were then hermetically sealed and buried in five large flower pots, three being sunk in the soil in the open air and the other two left without water (until the last three weeks of the experiment) in a shed. When the tubes were examined three months later, the three left out-of-doors contained only non-viable spores, as did also one of those in the shed, whereas the spores in the remaining tube had germinated and produced numerous sporidia. On 23rd February, 1942, pieces of healthy P.O.J. 36 cane shoots were placed in pots of heavily infested soil and gave rise to apparently sound plants which, however, after freezing during the succeeding winter, produced typically smutted buds in the spring. The problem of combating the disease has been complicated by its extension throughout the province, but stringent precautions in the matter of the destruction of infected buds should eliminate the smut in the course of two or three years since the spores in the soil die within a few months.

Cross (W. E.). **Observaciones y ensayos culturales relacionadas con el « carbon » de la Caña de Azúcar.** [Observations and cultural experiments in connexion with the 'smut' of Sugar-Cane.]—*Bol. Estac. exp. agríc. Tucumán* 37, 12 pp., 1942.

The sugar-cane varieties so far observed to be attacked by smut (*Ustilago scitaminea*) in Tucumán [see preceding abstract] are P.O.J. 36 and its variants M, striped, and Paz Posse (purple), and P.O.J. 234 (severely); Tuc. 472 (Señorita) (in a moderate degree); and Co. 270, 281, and 290, D. 1135, Kavangire, P.O.J. 2714, 2725, 2878, 2883, and 2961, S.N. 54, Tuc. 379, 630, 1111, 1406, 2605, 2611, 2613, 2622, 2634, 2645, 2651, 2657, 2680, 2683, 2701, and 2705, and Yon Tan San (mildly). The plots of susceptible varieties which were not infected by the middle of December, 1941, remained healthy for the rest of the season, but many con-

tracted the disease in the following spring. In the plots which showed smut symptoms in the spring of 1941, fresh infections appeared continuously among the newly developing buds, and in the succeeding spring the incidence of the disease was much higher than in the foregoing. The only cultural practice which seemed to bear in any way on the amount of smut infection was frequent spring watering, but climatic conditions exert an important effect on the course of the malady, which was favoured by the severe frosts of the two last winters and the protracted spring droughts, resulting in the debilitation and retarded development of the host.

LUTHRA (J. C.) & SATTAR (A.). **Control of Sugar Cane smut.**—*Indian Fmg*, iii, 11, pp. 594–596, 1 pl., 1942.

The outcome of the author's experiments in the control of sugar-cane smut (*Ustilago scitaminea*) in the Punjab has already been summarized from another source [*R.A.M.*, xx, p. 135], but it may be of interest to recapitulate the following points in connexion with the perpetuation of the disease by (a) planting setts of infected shoots, (b) spores borne on buds, (c) infection of the buds of standing canes, and (d) ratooning the smutted canes. The germination of setts from diseased shoots in the trial plots amounted to only 16 per cent., as compared with 44 for the healthy controls, while 10·2 to 62·2 per cent. of the buds from normal canes smeared with spores at planting time gave rise to infected canes. Smutted shoots were produced by some 20 per cent. of the infected buds of standing canes within three months; the inoculated buds which failed to sprout were sown in the field next season, and diseased canes arose from 4·3 to 28·3 per cent. of the contaminated material. The ratooned stumps of diseased canes were found to harbour the mycelium of the pathogen and to produce a fresh crop of smutted shoots.

CARVAJAL (F.) & EDGERTON (C. W.). **The perfect stage of Colletotrichum falcatum.**—Abs. in *Phytopathology*, xxxiii, 1, p. 2, 1943.

Old, dead sugar-cane leaves and leaf sheaths were observed during 1942 in Louisiana to bear abundant inconspicuous perithecia, entirely embedded in the tissues, of a species of *Physalospora*. In inoculation experiments with cultures from single ascospores, typical red-rot lesions with the characteristic conidia of *Colletotrichum falcatum* were obtained. The perithecia also developed on sterilized leaves inoculated in a moist chamber with pure cultures of *C. falcatum*, as well as on those transferred to a moist chamber after inoculation in the field. These organs agree closely with the description of the perithecia of *P. tucumanensis* Speg., the examination of a herbarium specimen of which labelled 'No. 418, separado, del tipo' from the Spegazzini Botanical Institute, La Plata, showed the perithecia to be slightly larger but otherwise in general agreement with the Louisiana red-rot fungus, which is therefore tentatively identified with *P. tucumanensis*.

McINTOSH (A. E. S.). **Progress in contributing colonies of seedlings released by the British West Indies Central Sugar-Cane Breeding Station.**—*Trop. Agriculture, Trin.*, xviii, 12, pp. 232–237, 1941.

Particulars are given of the reaction to disease and other characters of some 'noble' and 'nobilized' sugar-cane seedlings (the latter being derivatives of crossing wild species with the 'noble' *Saccharum officinarum* and back-crossing the progeny to the 'noble' parent) released from the British West Indies Central Sugar-Cane Breeding Station, Barbados, where the work of 'nobilization' was started in 1928. B.2935, the offspring of Ba.11569 × Ba.6032, is susceptible to mosaic and root diseases, but resistant to gumming [*Xanthomonas vasculorum*]. B.3439 (Ba.11569 × Q[ueensland] 813) is resistant to root rots and gumming, its reaction to mosaic in Barbados being variable; in Jamaica it shows a high degree of resistance to the last-named disease [*R.A.M.*, xxii, p. 79] and is altogether

probably the best general-purpose 'noble' cane ever produced at the Station, likely to assume a major commercial role in the British West Indies. B.34104(Co. 281 × B. H.10(12)) has so far been resistant to all the above-mentioned diseases in Barbados, but is highly susceptible to mosaic in Jamaica. B.35187 and B. 37161 (both 'nobilized') have given highly satisfactory results in Barbados in respect of resistance to all the diseases under observation.

ORIAN (G.). **Artificial hosts of the Sugar Cane leaf scald organism.**—*Rev. agric. Maurice*, xxi, 6, pp. 285–304, 2 pl., 1942.

A preliminary note on the results of the author's inoculation experiments on various plants with the agent of sugar-cane leaf scald (*Bacterium* [*Xanthomonas*] *albilineans*) has already appeared [*R.A.M.*, xix, p. 729]. The following further items of information are here presented. In the course of the investigations open leaf blades of the resistant DK 74, the fairly susceptible R.P.8, and the very susceptible Black and White Tanna varieties were found to respond positively to artificial inoculation with the bacterium through wounds, a method that had given negative results in the hands of other workers. Fine, reddish-brown, discontinuous streaks of varying lengths developed from the sites of inoculation in five to eight days, and the pathogen was reisolated from the infected tissues. In connexion with the colour of the streaks, the conspicuous white 'pencil' line, at any rate in Mauritius, almost invariably encloses a much finer, red streak, the former developing only if the vascular bundles of an expanding leaf contract infection before the plastids have turned green, and the latter due to the secretion by the host of a stain, not specifically associated with infection by *X. albilineans*, which occludes the vascular portion of the xylem with yellow to dark-coloured, gum-like masses. The susceptibility to infection of the open leaf blades may perhaps result in the passage of the causal organism from the newly emerged shoots into the stem. The fact that the normally resistant DK 74 sugar-cane variety, as well as a number of other plants immune from leaf scald in nature, readily react to inoculation with *X. albilineans* suggests that the behaviour of artificial hosts of a given pathogen does not necessarily afford a reliable criterion of their reaction to the disease in the field.

IKATA (S.) & YAMAUTI (K.). **Notes on the haustoria of some species of Peronospora.**—*Ann. phytopath. Soc. Japan*, x, 4, pp. 326–328, 6 figs., 1941. [Japanese.]

Sclerospora, *Plasmopara*, *Bremia*, *Pseudoperonospora*, and other genera of the Peronosporaceae have simple haustoria, but those of *Peronospora* are complicated in shape. The following observations were made on the haustoria of six species of this genus. (1) *P. schleideni* [*P. schleideniana*] on onion: mature haustoria tend to curl and some divide, but development is generally poor. The dimensions range from 80 to 100 by 2·3 to 5 μ or upwards. (2) *P. arborescens* on poppy [*Papaver somniferum*]: the young haustoria are sac-shaped, bending and dividing into a few branches at maturity, development being sparse. They measure 30 to 70 or upwards of 200 by 2 to 5 μ. (3) *P. media* on chickweed [*Stellaria media*]: the young haustoria divide and spread out at the tips, elongating at maturity when their dimensions are 15 to 70 by 2 to 7 μ. (4) *P. spinaciae* on spinach: the mature haustoria elongate and divide profusely, sometimes filling the host cells. They measure 5 to 7 μ in width (branches 2 to 4 μ). (5) *P. manshurica* on soy-bean: the young haustoria twist, coiling at maturity to resemble intestines, and measure 70 by 0·8 to 3 μ. (6) *P. brassicae* on radish: the haustoria are very different from those of all the other species examined, being flask-shaped when young with a neck 3 to 6 and a body 6 to 13 μ in diameter. Apical division usually occurs at maturity.

HOLMES (F. O.). **Quantitative measurement of a strain of Tobacco-etch virus.**—*Phytopathology*, xxxii, 12, pp. 1058–1067, 2 figs., 1 graph, 1942.

Under appropriate environmental conditions, well-marked, necrotic primary lesions developed on *Physalis peruviana* leaves five to ten days after inoculation with the severe-etch strain of tobacco etch [*R.A.M.*, x, p. 60], which induces on tobacco both chlorotic mottling and intricate patterns of fine, white lines simulating etching, this feature being absent from the other hosts of the virus. Quantitative measurements of severe etch could be made by using the number of lesions resulting from each inoculation as an index of the virulence of the inoculum. By this means *Nicotiana glutinosa* was ascertained to be the best of the various hosts compared as sources of inoculum, followed by tobacco and tomato. Virus activity in expressed tobacco juices reached a maximum about ten days after inoculation and then declined rapidly.

The severe-etch virus withstood desiccation for at least ten days in diseased leaves and juice samples, though its infectivity diminished in both cases with the passage of time. It also retained its activity for a similar period in acid-buffer solutions (P_H 4·5 to 6) at temperatures just above and below freezing. Some degree of virulence was further left in samples exposed for ten minutes to a temperature of 53° or half-an-hour to one of 51° C. but not after ten minutes at 55° or 30 minutes at 53° [cf. ibid., xx, p. 590].

WOODS (M. W.). **Effect of cyanide on synthesis of ring-spot and mosaic viruses in Tobacco.**—*Phytopathology*, xxxiii, 1, pp. 77–80, 1 fig., 1943.

The results of experiments under controlled conditions comparable to those obtaining in the writer's previous experiments on the inhibitory effect of sodium cyanide on the synthesis of the tobacco mosaic virus protein [*R.A.M.*, xix, p. 437] indicated that the infective principle of tobacco ring spot responds similarly to treatment with potassium cyanide (0·00015 to 0·0003 M.), which likewise reversibly blocks between 50 and 80 per cent. of the respiratory activity of the leaf [ibid., xxi, p. 228]. Biological assays for virus, in the form of local lesion counts on Turkish tobacco leaves, demonstrated the suppression by the chemical compound, not only of the necrotic symptoms of the disease, but also of the production of virus. For instance, in a test in which the ring spot-inoculated sectors were treated with 0·0003 M potassium cyanide for 24 per cent. of the entire time, a 55 per cent. reduction in virus titre was recorded, the same values in another trial being 22 and 41 per cent., respectively. When cyanide was administered at night only, the ring-spot lesions were much less necrotic and contained a smaller amount of virus than the controls or leaf sectors similarly treated during the day only, complete masking of the symptoms, in fact, resulting in some cases. These 'protected' diseased tissues continued to resist necrosis even after the discontinuance of the chemical treatment. In sectors treated with cyanide by day only, necrotic lesions developed, but more slowly and with a reduced virus titre in relation to the controls [cf. ibid., xiii, p. 477].

Whereas an external supply of nitrate (50 p.p.m. nitrogen) tended to diminish necrosis in ring spot-infected tobacco foliage, it stimulated the necrotic action of the yellow mosaic virus in the same leaves, but reduced the extent of peripheral yellowing in the lesions. Supplemental nitrate under the same conditions did not reduce necrosis due to yellow mosaic in a tobacco-*Nicotiana glutinosa* hybrid; but there was again a marked decrease in the amount of peripheral chlorosis. In the same hybrid, cyanide inhibited the synthesis of ring-spot protein, but in some cases there was a secondary stimulus to this process. In one experiment, for example, sectors were treated once with potassium cyanide for 23 hours, commencing 23 hours after inoculation, and 146 hours later, when the virus titre was determined, the extract from the cyanide-treated sectors produced 606 lesions as

against only 93 for the controls. The only prolonged alteration in the physiology of the hybrid tobacco leaves observed after exposure to cyanide was a marked reduction in the amount of brown pigment formed by oxidation (polyphenol dehydrogenase system) of tissues, which were killed by the virus after the cessation of the treatments.

BEACH (W. S.) & CHEN (S. Y.). **Experimental control of damping-off in Tomato seedlings transplanted from sand, including the immediate application of fungicidal drenches.**—*Bull. Pa agric. Exp. Sta.* 434, 26 pp., 3 figs., 1942.

In experiments conducted in Pennsylvania with the purpose of ascertaining whether lack of balance in nutrition in sand cultures can cause increased susceptibility to damping-off (*Pythium ultimum* and *Rhizoctonia* [*Corticium*] *solani*) in tomato seedlings after transplantation, no significant difference was found to exist between seedlings from ordinary sand cultures and those from steamed soil when transplanted into infected soil. Some evidence was obtained that over-concentration of nutrient salts, resulting in chemical injury, is a cause of increased susceptibility to damping-off. Considerable disease development was found to occur when washing the sand in hot water was omitted, this measure being essential for the removal of excess soluble salts and organic matter. Reduced moisture content of seed flats had no appreciable effect on the resistance of seedlings transplanted a comparatively short time after emergence; the resistance was slightly but significantly increased by extra potassium sulphate, but a high level of moisture had to be maintained to avoid chemical injury. After transplantation, seedlings showed a high degree of susceptibility to *P. ultimum* for about three days, and to *C. solani* for a much longer or even indefinite period. When *Pythium*-infested soil was thoroughly dried, damping-off was largely prevented, owing to the fact that the seedlings had passed their period of high susceptibility before the fungus could develop mycelium for attack. Optimum growing conditions, resulting in prompt renewal of growth after transplantation, tended to prevent damping-off. It is suggested that although under conditions of moderate attack the use of disease-free seedlings from sand cultures or steamed soil may reduce losses by approximately half in comparison with those incurred by the use of seedlings from untreated soil, yet in preventing severe losses, the maintenance of conditions unfavourable to damping-off development after transplantation is much more important than the resistance or the origin of the seedlings. Drying of infested soil and maintaining the most favourable conditions for growth of transplanted seedlings should insure complete absence of damping-off. In extreme cases, safe and efficient control can be obtained by applying fungicidal drenches to prepared flats of soil just before or after transplanting. In the present experiments, copper sulphate at the rate of 0·5 to 1 oz. to 30 sq. ft. was found to be effective against *P. ultimum*, particularly under moderate disease conditions, while semesan at the rate of 0·25 to 0·5 oz. and wettable spergon at that of 0·75 oz. to 30 sq. ft. were effective against both fungi. All these materials may be used dissolved or suspended in water at the rate of 1 pint to 1 sq. ft. It is advisable to rinse the fungicide from the stems and leaves with a limited amount of pure water and to place the plants where the foliage will dry readily but not in direct sunlight. Moist-chamber experiments indicated that some injury may occur under humid conditions; if these prevail, treatment of the soil before transplanting may be undertaken.

HEDAYETULLAH (S.) & SAHA (J. C.). **Bacterial wilt disease of Tomato.**—*Sci. & Cult.*, vii, 4, pp. 226–227, 1 fig., 1941.

At the Agricultural Research Station, Dacca, six seed and two soil treatments were tested, singly and in combination, for their efficacy in the control of tomato bacterial wilt (*Bacterium solanacearum*), which is stated to be assuming an alarming

character in various parts of Bengal, especially on red soils. Two varieties were used in the experiments, Dacca Farm and Sutton's Early Large Red, of which the former is the more resistant. Ten minutes' immersion in 1 per cent. mercuric chloride was the most effective of the seed treatments, and heating by burning a layer of rice stubble 3 in. in thickness and applications of kerol 1 in 400, 1 gal. per $30\frac{1}{4}$ sq. yds., the best of those applied to the soil. The heaviest yields were secured by a combination of kerol and 15 minutes' immersion of the seed in 2 per cent. copper sulphate.

Samson (R. W.) & Imle (E. P.). **A ring-spot type of virus disease of Tomato.**—*Phytopathology*, xxxii, 12, pp. 1037–1047, 2 figs., 1942.

This is an expanded account of the writers' studies at the Purdue University Agricultural Experiment Station on tomato ring spot, a preliminary note on which has already been published [*R.A.M.*, xvi, p. 501]. First detected in Indiana in 1930, the disease has since been found affecting up to 90 per cent. of the plants in many canning tomato crops in the southern part of the State, and has further been reported from Missouri and Illinois. Nine varieties, including Greater Baltimore, Marglobe, and Pritchard, have been observed to show spontaneous infection in the field, and the virus from tomato and *Datura stramonium* was successfully inoculated into other tomato varieties and 19 members of the Solanaceae, including potato, Turkish tobacco, *Nicotiana affinis*, eggplant, Ruby King pepper (*Capsicum frutescens*), *Hyoscyamus niger*, *Solanum pseudo-capsicum*, *S. carolinense*, and *Nicandra physaloides* (the two last-named and *D. stramonium* being natural hosts), two species of Amaranthaceae (*Amaranthus tricolor* and *A. retroflexus*), and one of the Martyniaceae (*Martynia louisiana*): from all these except pepper, *H. niger*, *A. retroflexus*, *S. pseudo-capsicum*, and *M. louisiana* the virus was recovered by return inoculation to *D. stramonium* and tomato. The symptoms of the ring spot closely resemble those of spotted wilt (though bronzing is not a characteristic feature), but the thermal death point of the former is higher (56° to 58° C. compared with 42°) and its host range narrower. Moreover, plants suffering from ring spot were not protected from infection by suspected spotted-wilt virus. The virus survived ageing in vitro for 21 hours compared with six for the tomato spotted wilt virus.

Differences in symptoms, host ranges, and properties indicate that the tomato ring-spot virus is distinct from the tobacco ring spot, potato ring spot, and tobacco ring mosaic viruses.

Tartakowsky (S. G.) & Arentsen (S. T.). **La roya del Alamo en Chile.** [The Poplar rust in Chile.]—*Bol. Sanid. veg., Santiago*, 1, 2, pp. 21–32, 1941.

Poplars in Chile, especially the widely cultivated *Populus nigra* var. *italica*, suffer severely from rust (*Melampsora larici-populina*) [cf. *R.A.M.*, xvii, p. 83], which was first recorded for the country by Spegazzini in *Rev. chil. Hist. nat.*, xxii, pp. 95–104, 1918, and subsequently mentioned in the archives of the Plant Protection Department in 1933, 1939, 1940, and 1941, an exceptionally severe outbreak having occurred in 1938, when the distribution of the pathogen extended from the province of Coquimbo to that of Chiloé. Although the disease was successfully combated in young (two- to three-year-old) plantings in 1939 to 1940 by spraying with 0·75 to 1 per cent. Bordeaux mixture, such a measure would be totally impracticable in the case of adult trees, which reach a height of 30 m. Control must therefore be based on the cultivation of resistant species, varieties, and hybrids, the most promising among those hitherto tested being *P. angulata*, *P.* sp. ('Calcufilo'), 'Arnaldo Mussolini' (*P. canadensis* × *P. nigra*), and German hybrid No. 7; specimens of *P. vernirubens* from Canada and ten hybrids from the United States proved susceptible (intensely so in some cases) to *M. larici-populina*.

Mook (P. V.) & Wolfenbarger (D. O.). **Distribution of Beauveria bassiana on Elm insects in the United States.**—*Phytopathology*, xxxiii, 1, pp. 76–77, 1943.

During 1941 and 1942 a survey was made for the presence of *Beauveria bassiana* on elm-inhabiting insects. Vera K. Charles reported the occurrence of the fungus on *Scolytus multistriatus* in New Jersey in 1941 [*R.A.M.*, xxi, p. 288], and the present report lists it as associated with the same host in Pennsylvania and Virginia, with *Hylurgopinus rufipes* in Massachusetts, New Hampshire, New Jersey, and Pennsylvania, with *Magdalis barbita* (1 out of 87), *M. armicollis* (1 out of 24), and *Tremex columba* (1 out of 1), in New Jersey, and with *Saperda tridentata* (10 out of 20) in New York. It is calculated that some 3 per cent. of all the insects cultured carried *B. bassiana, Scolytus multistriatus* and *H. rufipes* being the most important of its hosts in relation to the dissemination of Dutch elm disease [ibid., xv, p. 691; xxi, p. 433; *et passim*]. In the check list prepared by Miss Charles, 29 insect species or groups are cited as hosts of the fungus from 17 States ranging from Maine to Florida and from the Atlantic to the Pacific Coast, besides the District of Columbia, Canada, and the Dominican Republic.

Jones (T. H.) & Moses (C. S.). **Isolation of Ceratostomella ulmi from insects attracted to felled Elm trees.**—*J. agric. Res.*, lxvi, 2, pp. 77–85, 1 graph, 1 map, 1943.

With a view to identifying the species of insects spreading *Ceratostomella ulmi*, the cause of Dutch elm disease, insects were collected and cultured from 1936 to 1939 from felled healthy elm trees in several locations in New Jersey and New York States. The first year's collections were found to include 23 species of insects, as well as many other specimens that were determined only as to family or genus. *C. ulmi* was isolated most frequently from *Scolytus multistriatus* and *Hylurgopinus rufipes* [see preceding abstract], and also from *Xylobiops basilaris, Conotrachelus anaglypticus, Xylosandrus germanus*, and *Magdalis armicollis*. *S. multistriatus* and *H. rufipes* being considered the most important insect vectors of *C. ulmi* in the United States, only adults of these two species were cultured in the remaining years of these studies. In cultures made in 1936, 1937, 1938, and 1939, *C. ulmi* was isolated from 6·9, 5·8, 7·7, and 5·71 per cent. of the *S. multistriatus* insects, and from 4·3, 2·4, 3·3, and 0·7 per cent. of the *H. rufipes*, respectively. The percentage of insects contaminated with *C. ulmi* was found to vary considerably at different locations in the same year and at the same location in different years. Of the cultures made in 1936 and 1937, 71·2 and 76·6 per cent., respectively, were from *S. multistriatus* adult males. In 1936, *C. ulmi* was cultured from 6·9 per cent. of the males and from 7·1 per cent. of the females; in 1937 the percentages were 6 and 5, respectively.

Rupert (J. A.) & Leach (J. G.). **Willow blight in West Virginia.**—*Phytopathology*, xxxii, 12, pp. 1095–1096, 1942.

When the authors first observed the willow [*Salix*] blight in West Virginia in 1941 [*R.A.M.*, xxi, p. 355], the season was far advanced, and *Physalospora miyabeana* was the only organism associated with the diseased twigs. In May, 1942, however, *Fusicladium saliciperdum* [ibid., xxi, p. 544] was found fruiting profusely on infected petioles, while the acervuli of *P. miyabeana* were absent, though the fungus could be isolated from the cankers. In the following month, on the other hand, the acervuli of *P. miyabeana* were very active, whereas *F. saliciperdum* was distinctly on the decrease. The perithecia of *P. miyabeana* were detected in some of the cankers in the late summer and during the winter. Inoculation experiments with pure cultures of the two fungi showed *P. miyabeana* to be pathogenic to the stems and foliage of growing trees in the greenhouse and field, as well as to excised leaves in a Petri dish, in contrast to the failure of *F. saliciperdum* to attack growing

material and its feeble infection of detached leaves in a state of deterioration: the latter organism is therefore regarded as, at most, a weak parasite, comparable in its action to the species of *Cladosporium* and *Macrophoma* occurring in a saprophytic form on decaying material of outdoor willows.

SLEETH (B.). **Fusiform rust control in forest-tree nurseries.**—*Phytopathology*, xxxiii, 1, pp. 33–44, 1 fig., 1943.

Effective but not absolute control of *Cronartium fusiforme*, the numbers of seedlings of slash pines [*Pinus caribaea*] destroyed by which in southern nurseries in 1938, 1939, and 1940 were estimated at 4,000,000, 3,000,000, and 1,000,000, respectively, was secured at Brooklyn (Mississippi) by spraying with 8–8–100 Bordeaux mixture with the addition of santomerse S or an emulsion of raw linseed oil and fish oil soap, bi-weekly applications being given during the first two or three weeks and then one treatment a week until early June [*R.A.M.*, xx, p. 187]. In the case of mid-March sowings the initial treatments were applied on 8th and 12th April, when the uredosori of the rust were observed on oak leaves near the nursery, the corresponding date for the plots sown in mid-April being 2nd May, several days after the development of the sporidia. The seedlings from the mid-April sowings showed only ⅗ as many rust cankers as those of the earlier series. No appreciable reduction in the incidence of infection was obtained by the exclusion of oaks from a 1,500 ft. wide zone round a section of the nursery reserved for *P. caribaea*. Loblolly pines [*P. taeda*] grown under comparable conditions contracted less infection by *C. fusiforme* than *P. caribaea*, while longleaf [*P. palustris*] was even more resistant. Copper hydro (Chipman Chemical Co., Bound Brook, N. J.) was only slightly less effective than Bordeaux mixture, but dry lime-sulphur failed to give adequate control.

LUDBROOK (A. J.). **Nine years' work on Pine forest disease.**—*Aust. Timb. J.*, viii, p. 910, 1942. [Abs. in *Emp. For. J.*, xxi, 2, p. 145, 1942.]

This is a popular summary of investigations into needle fusion of *Pinus* spp. in New South Wales and Tasmania already noticed from other sources [*R.A.M.*, xxii, p. 119; see also ibid., xxi, pp. 312, 407].

Rust disease of Norway spruce.—*Gdnrs' Chron.*, Ser. 3, cxiii, 2935, p. 127, 1943.

Attention is drawn to a severe outbreak of rust [*Chrysomyxa rhododendri*] on Norway spruces [*Picea abies*] in several localities in Britain in the autumn of 1942, previous records of which in the Solway area and Aberdeenshire date from 1913 and 1916, respectively. The alternate host of the pathogen is *Rhododendron hirsutum*. A much more common disease of spruces in Great Britain is caused by *C. abietis*, the alternate host of which, if it exists, has not yet been discovered.

ENGLERTH (G. H.). **Decay of Western Hemlock in western Oregon and Washington.**—*Bull. Sch. For. Yale* 50, iv + 53 pp., 6 pl., 3 figs., 1942.

Observations of western hemlock (*Tsuga heterophylla*) stands from 1935 to 1940, involving the dissection of 801 trees, showed that the brown, stringy rot caused by *Echinodontium tinctorium* [*R.A.M.*, xx, p. 435] was not, as hitherto supposed, the most widespread agent of decay in this very important representative of the Pacific north-western forests, being confined to sickly trees at high elevations and on poor sites, and commercially negligible. *Fomes annosus* was shown to be responsible for 21 per cent. of the board-foot volume rotted, *F. pini* for 19·2 per cent., *F. applanatus* [*Ganoderma applanatum*] for 17·1, *F. hartigii* [ibid., xxi, p. 267] for 10·1, *G. oregonense* [ibid., xix, p. 445] for 7·2, *F. pinicola* for 6·7, *E. tinctorium* for 5·3, *Poria colorea* n. sp. for 4·3, *Armillaria mellea* for 3·7, *Polyporus sulphureus* for 2·3, *F. officinalis* for 1·5, *P. schweinitzii* for 0·9, and *Polystictus*

abietinus [ibid., xix, p. 315], *F. subroseus*, and *Poria subacida* for 0·1, 0·1, and 0·1 per cent. each. *F. annosus* and *G. applanatum* predominated along the coast, and *F. pini* and *F. hartigii* in the Cascade areas.

Infection was found to take place through scars inflicted by falling trees, mistletoe knots, broken tops, fire scars, lightning injury, and frost cracks beginning to be noticeable at 60 to 85 years and assuming a wide extension in 200-year-old trees. Although a greater proportion of infections occurred through falling-tree scars than through any other infection count, infections through mistletoe knots caused the greatest decay, amounting to 30·9 per cent. of the decay volume in board feet.

In order to form a reasonably accurate estimate of the amount of decay in western hemlock trees various indicators (e.g., sporophores, swollen knots, mechanical injuries, burls, branches hypertrophied by mistletoe, branch stools, and the appearance of the bark) may be used, while decay in logs may often be gauged from the stage of rot at the butt cut, the kind of rot being determined if possible by chopping into the punky knots, where the sporophores had been attached. The knowledge of the extent of decay thus obtained may be applied in estimating the value of sound trees, in making cull trees, and in measuring defective logs, with a consequent decrease in logging costs. Defective trees may be left standing to serve as seed trees if this is economically feasible. Little or no benefit is obtained by felling decayed trees in order to reduce the supply of inoculum. The best way of minimizing losses is to harvest the crop before it reaches the age when it is liable to appreciable decay.

P. colorea was found to be one of the more important butt rots in western hemlock. The sporophores are 3 to 7 cm. in diameter, annual, forming a tough coriaceous membrane with a broad sterile margin, and a pore surface which in dried specimens is pale yellowish-red or rust-yellow; the tubes are less than 1 mm. long, angular, and average 4 to 6 per mm.; the spores are broadly ellipsoid, smooth, hyaline, 4·5 to 6 by 3·5 to 4 μ; cystidia of a narrow-fusoid type, 16 to 20 by 5 to 7 μ, are occasionally present, and the hyphae of the subiculum, 3 to 4 μ in diameter, are thick-walled, non-septate, and without clamps. The sporophores resemble those of *P. subacida* but differ in colour. They usually occur in root crotches of living trees and may be easily overlooked. The rot is characterized by small, white, irregular streaks or pockets on the radial surface. These merge and the wood is reduced to a white, stringy, or finely reticulate mass. Black flecks are scattered throughout the decayed wood. The wood substance finally disappears leaving a hollow butt. The decay may be confused with that due to *F. annosus* but differs in that no blunt-pointed pockets are present.

HARRISON (C. H.). **Longevity of the spores of some wood-destroying Hymenomycetes.**—*Phytopathology*, xxxii, 12, pp. 1096–1097, 1942.

Under controlled laboratory conditions the spores of *Stereum hirsutum* freshly deposited by sporophores on glass slides and sown, after drying, on Sabouraud's dextrose agar at weekly intervals, were alive after 56 but not after 64 days' storage at room temperature, the corresponding periods for *S. rugisporum*, *S. sanguinolentum*, *Polyporus schweinitzii*, *Fomes igniarius*, *F. pinicola*, *Trametes* [*F.*] *pini*, *P.* [*Polystictus*] *abietinus*, and *Pleurotus ostreatus* being 45 but not 66, 131 but not 137, 162 but not 170, 91 but not 99, at least 173, at least 65, at least 65, and at least 20 days, respectively. Growth of *S. hirsutum*, *S. sanguinolentum*, *F. pinicola*, *Polystictus abietinus*, and *Pleurotus ostreatus* become visible in a week or less, while longer periods (up to two or three weeks) were requisite for the perceptible development of the other species. Germination of *F. igniarius* was erratic, some of the sowings failing to germinate. In an earlier test *Coniophora sistotremoides* spores grew when sown on casein-glucose potato agar after 46 but not after 68 days,

and those of *Hymenochaete tabacina* on walnut nutrient agar after 17 days' drying, growth being visible in 17 to 18 and four to five days, respectively.

TENG (S. C.). **Studies of Chinese timber trees in reference to forest management, I.**—*Sinensia*, x, 5–6, pp. 363–395, 7 graphs, 1940. [Chinese summary.]

The following observations are made on the wood-destroying fungi encountered in the course of the writer's ecological studies of the forests of north-western Yunnan and south-eastern Sikang (East Tibetan Plateau) in relation to silvicultural procedure. The Yunnan pine (*Pinus yunnanensis*) suffers extensively from a gall rust (? *Cronartium quercuum*), especially in open and pure stands on exposed sites. The same tree is a host of *Fomes laricis*, the agent of a brown, cubical heart rot, also affecting other conifers. A pecky heart rot of *P. yunnanensis*, Chinese larch (*Larix potaninii*), Likiang spruce (*Picea likiangensis*), hemlock (*Tsuga yunnanensis* and *T. chinensis*), and probably also the firs, *Abies georgei* and *A. chensiensis*, is caused by *F. pini* throughout the range of the investigations. The rot, which may extend into the sapwood, is characterized by numerous elongated pockets, usually filled with white fibres, the surrounding heart wood often being stained purplish or reddish, while the decayed areas themselves may be intersected by narrow, brownish to blackish lines. *F. putearius* Weir induces a decay very similar to the foregoing in *P. likiangensis*, *A. georgei*, and probably also in *L. potaninii*.

A prevalent, brown, cubical heart rot of the upper part of *P. likiangensis* trunks is caused by *F. carneus*, the decay apparently proceeding more rapidly after the death of the trees. *Polyporus dryadeus*, a well-known oak parasite, attacks *A. georgei* in south-eastern Sikang, inducing a soft, white rot of the butt and root-heart and sapwood. *P. volvatus* is found in abundance on *Pinus yunnanensis* trunks. A white pocket rot of *Picea likiangensis* sap and heartwood is caused by *Stereum sulcatum* and *S. chailletii*, while *S. sanguinolentum* is the agent of a similar decay of *A.* and *T.* spp. A powdery, brown rot of red paper birches (*Betula albo-sinensis*) in Sikang is due to *Polyporus betulinus*. *P. gilvus* produces a white rot of prickly oak (*Quercus semicarpifolia*) sapwood, which often cracks along the annual rings. Various broad-leaved trees, including birch, oak, and poplar, are subject to the pocket sapwood rot caused by *P.* [*Polystictus*] *pergamenus*, many hardwoods also being attacked by *P. versicolor*, the agent of a white, spongy decay of the sapwood. The prickly oak is also a host of *Trametes sepium*, which caused a brown, crumbly rot of the sap and heartwood. A white, spongy decay of many kinds of poplars is attributable to *T. hispida*.

The following fungi, already reported from the Hunba Forest (*Sinensia*, x, pp. 249–268, 1939), have likewise been encountered in the regions under observation: *F. pinicola* on *Pinus yunnanensis*, *Picea likiangensis*, *A. georgei*, and *Larix potaninii*, *F. annosus* on *P. likiangensis* and *A. georgei*, *F. fomentarius* and *Ganoderma applanatum* on prickly oak and red paper birch, *F. igniarius* on the last-named, poplar, and willow [*Salix*], *P. abietinus* on *Pinus yunnanensis*, *Picea likiangensis*, and *A. georgei*, *Polyporus schweinitzii* on *L. potaninii* and *A. georgei*, *P.* [*Polystictus*] *hirsutus* on red paper birch, and *Lenzites sepiaria* on *Pinus yunnanensis*.

HILBORN (M. T.) & STEINMETZ (F. H.). **The calorific value and chemical composition of decayed cordwood.**—*Phytopathology*, xxxiii, 1, pp. 45–50, 1943.

In further studies (initiated by the senior author) in Maine on the effects on chemical composition and calorific value of the cordwood of red maple [*Acer rubrum*], paper birch [*Betula papyrifera*], and beech of decay by the white-rotting fungi, *Polyporus* [*Polystictus*] *hirsutus*, *Polyporus* [*Polystictus*] *pergamenus*, *Panus stipticus*, *Stereum purpureum*, *Thelephora* sp., and *Daldinia* sp. [*R.A.M.*, xvi, p. 138], two characteristics of this group of organisms were observed, namely,

the absence of a correlation between alkali solubility and the loss of any other component, and a depletion of cellulose and lignin proportional to the disorganization of the wood substance. One feature typical of the brown rots (which may have been present in the material examined, though their fructifications were not identified) was also noticed, namely, the preferential selection of the pentosans in cellulose. Chemical analyses failed to demonstrate a correlation between reduction in calorific value and reduction in amount of any chemical constituent and did not explain the slower loss in calorific value than in wood substance. Particle size resulting from mechanical screening in the reduced samples was shown to influence calorific value, which was higher in the minute particles passing the 100- and 200-mesh sieves than in those retained and submitted to chemical analysis.

REID (D.). **Creosote penetration in Tabonuco wood as affected by preliminary boiling treatments in organic solvents.**—*Caribb. Forester*, iv, 1, pp. 23–34, 6 figs., 1942. [Spanish summary. Mimeographed].

The treatment of heartwood of tabonuco (*Dacryodes excelsa*), an important Puerto Rican timber, by standard preservative methods presents great difficulty owing to the hindrance of penetration by the presence of infiltrations of organic matter in the cell walls. This obstacle was overcome by the preliminary boiling of the wood for ten hours in kerosene [paraffin], which increased the penetration of creosote from 42·5 per cent. in the oven-dry control specimens to 70·3 per cent., the standard error of each of these averages being $\pm 6{\cdot}4$ per cent.

SZIRMAI (J.). **Újabb megfigyelések a palántak szártőbetegségéről.** [Recent observations on the damping-off of seedlings.]—*Mezőgazdas. kutatás.*, xiv, 4, pp. 125–127, 1941. [German summary.]

Among the economic plants affected by damping-off in Hungary are potato, tomato, chilli, lettuce, tobacco, and cabbage, and investigations were conducted at the Nagybakta Agricultural Experiment Station to determine the relative importance of *Rhizoctonia* [*Corticium*] *solani* and *Pythium de Baryanum* in the etiology of the condition. *C. solani* was found to be the predominant agent of the root rot and has probably been responsible for most of the damage from this source of recent years, *P. de Baryanum*, on the other hand, being only sporadically represented.

MYERS (C. E.). **The Penn State Ballhead Cabbage. Some problems encountered in its development.**—*Bull. Pa agric. Exp. Sta.* 430, 52 pp., 48 figs., 1 graph, 1942.

The section of this bulletin dealing with the control of the pests and diseases encountered in the breeding of the Penn State Ballhead cabbage (pp. 28–34) contains the following items of interest. In 1940 a serious outbreak of disease caused by a species of *Alternaria*, probably *A. brassicae*, began to give trouble under storage conditions. This disease and black leg [*Phoma lingam*] were successfully controlled in seed plants by the following method: seed was treated with hot water (50° C. for 25 minutes), followed by a 20 minutes' steep in mercuric chloride solution (1 in 1,000), and then sown on land which had not been planted to cabbage oftener than once in four years. Apparently disease-free plants were selected for seed, the outer leaves removed, the soil washed from the roots by water from a hose, and the plants dipped in mercuric chloride solution before being placed close together in the trenches in which they were stored for the winter, covered with protecting boards and with soil scattered on the roots. In 1941, in a planting of $1\frac{3}{4}$ acres only four plants were observed to be injured by black leg and one by *Alternaria*. Yellows [*Fusarium conglutinans*], though prevalent elsewhere in the State, has only once been observed at the Station, in July, 1934,

when the two infected plants were removed and burnt, the soil of the site they had occupied drenched with a 10 per cent. solution of formalin, and a barricade erected to prevent ingress to the focus of infestation. In the following year one more diseased plant was detected and similarly treated, since when there has been no recurrence of the trouble. Infection is suspected to have been conveyed by a field assistant from an infested garden $1\frac{1}{4}$ miles distant.

WALKER (J. C.), JOLIVETTE (J. P.), & McLEAN (J. G.). **Boron deficiency in Garden and Sugar Beet.**—*J. agric. Res.*, lxvi, 3, pp. 97–123, 6 figs., 1943.

The development of boron deficiency symptoms in seedlings of garden beet [*R.A.M.*, xxi, p. 442] grown in quartz-sand culture was observed in the greenhouse in Wisconsin. In seedlings grown from the beginning in nutrient solutions free from boron, symptoms developed promptly as an intensification of red pigment, unilateral development of leaf lamina, stunting, and death of the growing point. When seedlings were transferred to boron-deficient solutions after 30 to 40 days of healthy growth, similar symptoms appeared more slowly. In garden beets grown in nutrient solution until the tap-root had enlarged, typical black spot gradually appeared in the recently formed vascular rings on the boron supply becoming exhausted. Plants raised in the greenhouse on soil from fields where severe black spot of garden beet or heart rot of sugar beet had occurred did not show acute symptoms, and diagnosis of boron deficiency by pot tests was not satisfactory.

In field experiments conducted from 1938 to 1941, application of borax to the soil consistently reduced the amount of internal black spot in garden beets and of heart rot in sugar beets. Other minor elements, such as manganese, zinc, copper, iron, and cobalt, applied as soluble salts, had no effect on disease development. Smaller amounts of borax were needed to control heart rot than internal black spot, the latter disease defying as heavy applications as 100 lb. borax per acre. A survey of Wisconsin fields during the growing seasons of 1937, 1938, 1939, and 1940, showed that internal black spot was present most frequently in soils with a neutral or alkaline reaction, from light sandy to dark silty clay loam, and was about equally prevalent in high and low parts of the field. Broadcast applications of borax to slightly alkaline Poygan silty clay loam in 1938 prior to planting, were effective in entirely eliminating heart rot for two successive seasons and partly so for the third, and in much reducing internal black spot for two seasons, without causing injury to either garden or sugar beet even at rates as heavy as 60 lb. borax per acre. Application of borax with the fertilizer in bands $1\frac{1}{2}$ to 2 in. removed from and at the same depth as the seed were as effective as broadcast treatments. Yields of garden beets were commonly but not invariably increased by borax treatment. An increase in yield was observed in one case where the boron naturally available in the soil was sufficient to prevent internal black spot. Black spot was effectively controlled by mid-season applications of borax, particularly in liquid form, when carried out just before or immediately after the appearance of first symptoms. The canning quality of garden beet was not impaired by applications as heavy as 100 lb. borax per acre. On plots of Antigo silt loam supplied with various amounts of lime in 1935, black spot appeared five years later only where the soil reaction was alkaline. In plots of Plainfield sand similarly treated, however, black spot appeared everywhere (and severely in one with a P_H reading as high as 6·0 in one year), increasing with heavier dosages of lime. It is concluded that soil types differ in the degree to which available boron is tied up by liming and that in sandy soil boron deficiency is intensified by liming without the soil approaching an alkaline reaction and that some of the boron remains unavailable to plants over a period of several years.

Gaskill (J. O.). **Effect of mosaic upon yield of seed by Sugar Beet roots.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 199–207, 1940. [Abs. in *Sugar*, xxxviii, 2, p. 36, 1943].

Mosaic disease is stated to be widespread among the several hundred acres of sugar beet produced annually in northern Colorado, largely by the ordinary 'steckling' method, and a two-year series of experiments revealed a difference of 34·97 per cent. in seed yield between plots planted with diseased and healthy roots, heavy losses resulting both from first- and second-year infection.

Mujica (F.). **La septoriosis del Apio.** [The septoriosis of Celery.]—*Simiente, Santiago de Chile*, xii, 2, p. 81, 1943.

This is a popular note on celery blight [attributed to *Septoria apii* and *S. apii-graveolentis* in the Argentine: *R.A.M.*, xvii, p. 498; xx, p. 9], the losses due to which in Chile are estimated to average 10 to 15 per cent. of the value of the crop, covering 150 to 200 ha., i.e., a minimum of $150,000 per annum. Obviously the most rational method of control is that based on the observations of Krout in the United States, consisting in the use of three-year-old seed, since the spores of the pathogen lose their viability after the second year. The application of disinfectants to the seed is attended by various disadvantages, hot water and mercuric chloride, for instance, being more or less injurious to the seed, while formalin, though comparatively innocuous, is not so effective. Once infection has actually appeared in the plantings, regular treatments with 1 per cent. Bordeaux mixture should be given.

Bucha (H. C.). **Seed treatment as an aid in the wartime production of Peanuts.**—*Agric. News Lett.*, x, 5, pp. 114–122, 1942. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 2, p. 209, 1943.]

Seed decay in the soil is stated to be largely responsible for sparse stands of groundnuts, resulting in low yields. In the author's greenhouse and field trials, the sulphur compound 50 per cent. tetramethyl thiuram disulphide (Du Bay 1205-FF) compared very favourably with ceresan in the prevention of rotting and stimulation of emergence. The routine application of seed treatment should provide a simple and inexpensive means of increasing farm incomes and simultaneously of meeting the greatly enhanced war-time demand for groundnut oil.

Fawcett (G. L.). **Una enfermedad comun de la Vid.** [A common Vine disease.]—*Circ. Estac. exp. agríc. Tucumán* 112, 2 pp., 1 fig., 1942.

Vine anthracnose [*Elsinoe ampelina*] is prevalent every year in Tucumán, Argentine, where grape production, however, is not as important as elsewhere in the Republic. Diseased vines cannot be saved, but the following preventive measures may be adopted. During the winter, after pruning, the dry twigs and shrivelled bark should be removed, and a mixture of 3·5 kg. iron sulphate, 70 c.c. sulphuric acid, and 10 l. water applied to the trunk and thicker branches with a brush or rag. In the case of small vineyards the sulphuric acid component of the fungicide may be omitted, its inclusion not being essential and requiring extreme care on the part of the operators. A solution of 1 per cent. copper sulphate may also be used during the dormant period, but neither this nor iron sulphate should be applied later for fear of injury to the leaves and buds. Subsequent treatments should consist of Bordeaux mixture (1 per cent.), the first as soon as the racemes are formed and thenceforward at intervals of one, two, or three weeks.

Jenkins (Anna E.) & Bitancourt (A. A.). **La antracnosis de la Vid en Chile. Resumen.** [Vine anthracnose in Chile. Summary.]—*Bol. Sanid. veg., Santiago*, 1, 2, pp. 33–34, 1941.

The late arrival of the summary (translated into Spanish by F. Mujica) of the

authors' paper on vine anthracnose (*Elsinoe ampelina*) in Chile precluded its appearance at the time of publication [*R.A.M.*, xxi, p. 481].

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xvi, 12, p. 170M, 1942.

'Germany (Sudeten Territory).' A Decree of 14th July, 1942, relative to hop mildew (*Pseudoperonospora humuli*) control, prescribes the training of the shoots to a height of at least 4 m. from the ground, along which they must not be allowed to trail. A maximum of three shoots may be kept as reserve stock. Diseased shoots should at once be removed and burnt. At least three times a year the hop gardens should be sprayed with copper washes or treated in some other manner recognized as effective by the Plant Protection Service. Plant refuse left in the field after harvest should be removed before the leaves turn yellow and burnt within four weeks unless required for any other purpose.

Martyn (E. B.). **Plant Pathological Division.**—*Rep. Dep. Sci. Agric. Jamaica 1941–42*, pp. 11–12, 1942.

Croucher (H. H.). **Leaf Spot Control Division.**—loc. cit., p. 12.

In his report on plant disease work in Jamaica [cf. *R.A.M.*, xxi, p. 241], E. B. Martyn states that during the period under review Panama disease of bananas *Fusarium oxysporum* [var.] *cubense* continued to increase, though checked to some extent by dry weather. There were in all 684,085 cases treated, 772 new cases, and 667,619 recurrences. These figures were lower than those for the previous year, owing to further abandonment of treatment and withdrawal of inspectors in the eastern parishes in localities where the eradication of affected plants no longer serves any useful purpose. Banana leaf speckle was ascertained to be due locally to the same fungus that causes the disease in Surinam [*Chloridium musae*: ibid., xvi, p. 476]. A case of plantain wilt in a Kingston garden was suspected to have been caused by 'moko' disease, but the causal organism, *Bacterium solanacearum* [ibid., xix, pp. 158, 662], was not isolated. The black scabs typically appearing on the leaves and fruit of the Tiger plantain were recognized as being similar to those described and figured by Wardlaw (Diseases of the Banana, 1935, p. 273) in his account of a disease of 'black' plantains in Martinique. A similar condition slightly blemished a few Gros Michel fruits. The scabs, which appear to be superficial, are possibly due to insect injury.

Examination in the field of coco-nuts affected with bronze leaf wilt [*R.A.M.*, xxi, p. 242] confirmed the view that the disease is not infectious and is due to environmental conditions.

Carrot leaf blight (*Macrosporium carotae*) [ibid., xx, p. 560], though reported only once before, appears to be moderately prevalent, though it is not, as a rule, serious; its incidence is seasonal.

Rust-coloured patches on the trunk and lower limbs of pimento trees may, it is thought, have been caused by scorching of the new bark during dry weather.

New records for Jamaica included leaf spot (*Cylindrocladium* sp. near *C. scoparium*) of bullet wood (*Dipholis salicifolia*) seedlings, onion leaf spot (*Alternaria porri*), rice brown spot (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*], and turnip leaf spot (*Colletotrichum higginsianum*).

In his report on leaf spot [*Cercospora musae*: ibid., xxi, p. 242; xxii, p. 33], H. H. Croucher states that intensity of incidence resembled that of the previous year, save for unimportant fluctuations. A slight increase occurred in the eastern districts, which, however, are still among those least affected. Control measures are necessary only in small areas in Portland parish, a locality where the rainfall is very heavy. In the Montego Bay River Valley, which still contains the largest block of bananas in Jamaica, the effects of soil erosion have become so serious that

whereas the entire area was recently an almost uninterrupted field of bananas, the ridges are now exposed, and banana cultivation is receding down the slopes of the secondary ridges. Panama disease, confined until recently to the lower sections, is now attacking parts of the slopes. Excellent control of *C. musae* by spraying with Bordeaux mixture or perenox has been maintained, especially by the larger growers, who carry out the treatments regularly and efficiently. Some of the growers who formerly used perenox have now discarded it in favour of Bordeaux mixture, because of the better visibility of the latter, which facilitates supervision of the spraying.

The duties of officers of the Leaf Spot Control Division in controlling the supplies of spraying material and equipment issued by the Banana Leaf Spot Control Board have been modified by the introduction, in two areas, of a system by which, instead of each company assuming responsibility for the supervision of the spraying effected by its contractors, a joint Committee supervises the spraying done by all the growers. The Board has bestowed wide powers on these committees as regards the distribution of equipment and material, with the result that the duties of the Government Officers have been correspondingly reduced. The system has not been applied to the Eastern Division.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xl, 12, pp. 635–639, 6 figs., 1942.

Even under conditions strongly favourable to infection, peach fruits in the Goulburn Valley, Victoria, do not, apparently, become susceptible to rust (*Puccinia pruni-spinosae*) [*R.A.M.*, xxi, p. 123] until December at the earliest, with the result that fruit infections occur only when the summer rains fall in that month or later. In addition to favourable weather conditions a spore load from earlier leaf infections must be present before fruit infection takes place. If no leaf infection is detected between early spring and December, spraying becomes superfluous; if, however, such infection is found, a spray should be applied in December to protect the fruit. Dry-mix lime-sulphur (16 lb. dusting sulphur, 8 lb. hydrated lime, and 1 lb. lime casein spreader used in the proportion of 25 lb. of the mixture per 100 gals. water) is recommended; with late canning peaches, a second application may be necessary against very late fruit infection.

Peach leaf curl (*Taphrina deformans*) [ibid., xxi, pp. 147, 338] can be completely controlled by thorough spraying with Bordeaux mixture (6–4–40) in the very early pink-bud stage.

Blossom-end rot of tomatoes [ibid., xxi, p. 541] is common locally, particularly in the northern parts of Victoria, but responds to any treatment that helps to maintain an even soil moisture content.

Science for the farmer.—*Rep. Pa agric. Exp. Sta., 1941–42* (*Bull.* 429), 44 pp., 15 figs., 1942.

On p. 11 of this report [cf. *R.A.M.*, xxi, p. 522] it is stated that twelve or more strains of potatoes resistant to blight [*Phytophthora infestans*], tested by W. R. Mills in Pennsylvania, appeared to be very promising. Seed supplies are being rapidly increased and placed in yield tests. In tests by H. W. Thurston potatoes sprayed with Bordeaux mixture 8–8–10, 8–4–100, yellow copper oxide, and tribasic sulphate yielded, respectively, 415, 371, 372, and 412 bush. per $\frac{1}{100}$ acre, indicating the possibility of using the two last-named substances in place of Bordeaux mixture. Both plots sprayed with the substitute coppers showed more tip-burn and matured a week to ten days earlier than the others.

On p. 35 W. S. Beach is stated to have found that thorough drying of soil heavily infected by *Pythium* almost completely controlled damping-off when vegetable

seedlings were transplanted to it. Treatment with semesan, copper sulphate, and spergon (chloranil) was also safe and effective.

Fifty-fourth Annual Report of the Vermont Agricultural Experiment Station, 1940–1941.—*Bull. Vt agric. Exp. Sta.* 475, 40 pp., 1941. [Received April, 1943.]

The following items of phytopathological interest occur in this report. Eight out of ten proprietary brands of wettable and flotation sulphur tested by M. B. Cummings and C. H. Blasberg for their efficacy against apple scab [*Venturia inaequalis*] gave satisfactory control, reducing leaf infection from 66·5 to between 0 and 8·8 per cent. and fruit infection from 90·2 to between 0·81 and 3·6 per cent., the incidence for lime-sulphur (1 in 50) being 0·25 and 1·27 per cent., respectively. Three of the preparations, however, caused severe russeting (up to 30·55 per cent.), apparently owing to the use of a commercial oil as a sticker and spreader.

B. F. Lutman has found the potato scab (*Actinomyces*) [*scabies*] problem to be much more complex than was formerly supposed. The most prolific growth and the maximum of infection have been observed on areas retaining the most moisture after rainfall [ibid., xxi, p. 156]. Laboratory studies on early infection of young tubers by the pathogen [loc. cit.] indicate that not only scabby ones but all contain hyphae between the cells in the walls and in the intercellular spaces.

Fifty-second Annual Report for the fiscal year ended 30th June, 1942.—*Bull. Wash. St. agric. Exp. Sta.* 425, 121 pp., 1942.

In the section of this report [cf. *R.A.M.*, xx, p. 346] dealing with plant pathology (pp. 65–75), the following items are of special interest, apart from others already noted.

C. S. Holton confirmed the identity of the five new races of wheat smut (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) described in 1940 [ibid., xx, p. 347; xxi, p. 329]. New collections of both fungi totalled 135, one of which may be a new race. Pathogenicity in the bunt fungi appears to be inherited on a multiple factor basis. Transgressive inheritance of pathogenicity factors is indicated by the fact that some hybrid segregates with more, and others with less virulence than either parent were obtained. Turkey (C.I. 10098) was resistant to all except the Oro race (L-8), Akron (C.I. 11660) was susceptible to all races, and Brevon (C. I. 11912) was resistant to all except the Ridit races (T-11, L–9, L–10). Eleven wheat × *Agropyron elongatum* selections were tested for bunt resistance; six were resistant and five susceptible, infection ranging from 13·1 to 81·8 per cent.

Flag smut of wheat (*Urocystis tritici*), first observed in Washington in 1940 [ibid., xx, p. 107], was more prevalent in 1941, being found in 21 of 58 fields near Goldendale; infection ranged from a trace to about 3 per cent. Eighty winter and spring wheat varieties were tested for resistance to flag smut, and most, including the leading commercial varieties of the Pacific Northwest, were found to be highly susceptible. A few varieties, however, were highly resistant, a supply of resistant parent stock for breeding purposes being thus assured.

A survey by L. Campbell of beet fields in Skagit County showed that the beet seed industry is in a precarious position. In the leaves of the seed stalks islands of necrotic tissue appear in spring, and the whole stalk rapidly dies; in many cases the mother beet decays. The yields are reduced by 50 to 60 per cent. In a high percentage of the plant beds the stecklings failed to develop vigorously; the leaves reddened prematurely and many of the beets failed to become large enough to store. Black root [*Phoma betae*: loc. cit.], mosaic [ibid., xvii, p. 440], and downy mildew [*Peronospora schachtii*: ibid., xx, p. 333; xxi, p. 317], though common, were serious in only a few beds and the trouble appears to have been primarily due to drought and malnutrition.

G. W. Fischer states that in 1939 mature plants of slender wheatgrass [*Agropyron*

tenerum], crested wheatgrass [*A.* sp.], and Canada wild rye (*Elymus canadensis*) were inoculated by clipping back and spraying with spore suspensions of *Ustilago hypodytes*. In 1940, no infection developed, but in 1941 three rows of slender wheatgrass inoculated with *U. hypodytes* from quack grass, giant wild rye [*E.* sp.], and blue wild rye (*E. glaucus*) showed slight stem smut. Early in 1942 a substantial amount of stem smut appeared in the same rows, while corresponding rows of Canada wild rye and crested wheatgrass were also affected. Attempts to secure infection by inoculating the seed or flowers failed.

Morphological comparisons by J. G. Harrar and D. M. Coe of numerous isolates of *Sclerotinia sclerotiorum* and *S. trifoliorum* from various hosts revealed no significant differences between isolates of the former from leguminous or non-leguminous plants, or between isolates from different parts of the State and country. No morphological differences were observed between *S. trifoliorum* isolates from eastern or western Washington or from other parts of the country. *S. trifoliorum* was found to produce most of its apothecia during autumn and early winter, while *S. sclerotiorum* produces its apothecia at any season. *S. sclerotiorum* was isolated from lucerne on several occasions, but most cases of lucerne crown rot gave *S. trifoliorum*, which was also isolated from red clover (*Trifolium pratense*), lentil, and *Lotus corniculatus*.

J. D. Menzies and J. G. Harrar state that in studies on witches' broom of lucerne [ibid., xix, p. 459], a serious problem in localized areas of Washington, graft transmission was conclusively demonstrated, being obtained by both root and top grafts. Transmission did not result from mechanical contact by rubbing, from juice inoculations, or from the use of dodder, and the evidence does not suggest that the disease is seed-borne. It occurs naturally on lucerne, and the same condition, or one closely similar, has been noted on red and white clovers (*Trifolium pratense* and *T. repens*). *Medicago lupulina* was artificially infected by grafting, and mild symptoms resulted, but no infected plants have been seen in the field.

Studies by L. Campbell on the running-out diseases of strawberries showed that in western Washington yellows [yellow edge] is the most important factor [ibid., xx, p. 348], the principal variety grown locally being Marshall, which is highly susceptible. Root rots [loc. cit.] are less important than yellows in the running-out of Marshall strawberries, but cause some loss, and are very serious on other varieties in some places.

L. K. Jones states that large plantings of the Cuthbert blackberry variety in western Washington do not show any green mosaic. Plantings of the Washington variety in 17 counties were free from mosaic, although this variety had been exposed to the disease in adjacent stock for two or three years. The varieties Indian Summer, Lloyd George, Marcy, Newburg, and Taylor have in the past been considered to be resistant to mosaic, but they were all observed to be affected.

Carnation bacterial wilt (*Phytomonas caryophylli*) [ibid., xxi, p. 325] was noted in only one greenhouse in the State. The disease is perpetuated from year to year in cuttings from affected plants and in soil from which diseased plants have been removed. Carnations in one greenhouse are still seriously affected by bacterial leaf spot (*P. woodsii*) [ibid., xiv, p. 365]; the disease was introduced into the State in cuttings in 1940. Thorough spraying with Burgundy mixture (4–6–50) and care in selecting cuttings have failed to eliminate the disease from three affected varieties.

Inoculation experiments demonstrated that the spotted wilt virus was quite damaging to one *Chrysanthemum* variety in one greenhouse. The virus appeared to have been carried by *Thrips tabaci* from affected cineraria plants [cf. ibid., xiv, p. 201]. Experimental evidence showed that the viruses causing cineraria streak and mosaic are often seed-borne, and that careful seed selection offers a practical means of control. Evidence was obtained that the cineraria streak virus is transmissible to tomato by mechanical inoculation.

Marked differences in susceptibility to carnation yellows [ibid., xx, p. 348] appeared in inoculation tests with 17 seedling varieties. Five new seedling varieties seem to be well adapted to commercial production, and two of them show strong resistance. Two viruses appear to be associated with the condition.

Principales enfermedades parasitarias que fueron objeto de consulta en el segundo semestre (Julio-Diciembre) de 1941. [The principal parasitic diseases which were the object of consultation during the second half (July to December) of 1941.]—*Bol. Sanid. veg. Santiago*, i, 2, pp. 52–55, 1941.

Included in this tabulated list of plant pathogens investigated by the phytopathological staff of the Chilean Ministry of Agriculture from July to December, 1941 [cf. *R.A.M.*, xxi, p. 443] may be mentioned *Bacterium* [*Xanthomonas*] *juglandis* on walnut, *Colletotrichum dianthi* on carnation, *Cycloconium oleaginum* on olive, *Diaporthe citri* and *Leptothyrium pomi* on orange, *Fusarium annuum* on chilli [ibid., xix, p. 676], *Melampsora bigelowii* on *Salix nigra* [ibid., xviii, p. 642], *Peronospora hyoscyami* on tobacco [ibid., xvi, p. 65], *Phytomonas* [*Bacterium*] *tumefaciens* on olive and quince, *Physalospora malorum* [*P. obtusa*] on apple, *Pseudopeziza medicaginis* on lucerne, *Puccinia sorghi* [*P. maydis*] on maize, *Sclerotinia fuckeliana* [*Botrytis cinerea*] and *Uncinula necator* on vine, *S. libertiana* [*S. sclerotiorum*] on onion, lemon, fig, and *Camellia japonica*, *S. minor* on *Lotus corniculatus*, *Sphaeria* [*Mycosphaerella*] *fragariae* on strawberry (*Fragaria chilensis*), *Tranzschelia* [*P.*] *pruni-spinosae* on peach, *Uromyces betae* on beet, and *Ustilago bromivora* on *Bromus unioloides*. Among the non-parasitic diseases listed separately on p. 56 of the *Boletin* are needle fusion of *Pinus insignis*, exanthema of citrus, and potassium deficiency [leaf scorch] of apple.

Braun (A. C.) & White (P. R.). **Bacteriological sterility of tissues derived from secondary crown-gall tumours.**—*Phytopathology*, xxxiii, 2, pp. 85–100, 2 figs., 1943.

In further studies on the bacteriological sterility of tissues derived from secondary crown-gall (*Phytomonas* [*Bacterium*] *tumefaciens*) tumours on sunflowers [*R.A.M.*, xxii, p. 12], involving over 2,000 tests of various kinds, the organism failed to develop under the most favourable nutritional and environmental conditions. Negative results were likewise obtained by the application of special methods appropriate to the isolation of small numbers of bacteria or of dormant phases, filterable or non-cultivable forms, or viruses. The implantation of such tumour-tissue cultures in sunflower and tomato gave rise to typical crown-gall tumours which again did not yield *Bact. tumefaciens* in response to the usual tests, while the use of the same material as an antigen in agglutination and complement-fixation experiments also disclosed no trace of the pathogen.

The evidence here presented is considered to offer unexceptionable grounds for the conclusion that the tumour-tissue cultures isolated from secondary excrescences are entirely free from *Bact. tumefaciens* or other identifiable tumour-stimulating agents. Such bacteria-free cells of crown-gall tumours show many essential features of true malignant animal cells, and thus represent a potential source of information on certain basic principles involved in the etiology of malignancy.

Braun (A. C.). & Laskaris (T.). **Tumor formation by attenuated crown-gall bacteria in the presence of growth-promoting substances.**—Abs. in *J. Bact.*, xlv, 2, p. 196, 1943.

An attenuated culture of *Phytomonas* [*Bacterium*] *tumefaciens* produced large tumours on tomato plants when supplemented with growth-promoting substances, either in synthetic or plant hormone form. Fragments of such artificially induced

tumours, introduced into healthy tomato plants, developed into typical large excrescences in four to five weeks. The neoplastic tissues have now been carried through five consecutive passages in tomato plants covering a period of six months. One clone of tumour tissue isolated was absolutely free from crown gall bacteria [see preceding abstract]. Fragments of this tissue grew rapidly into large tumours similar to those containing bacteria. The growth substances alone were shown to be incapable of inducing tumour formation in the host cells, this being apparently a function of the attenuated culture. The latter by itself, however, is unable to cause any further appreciable stimulation of the altered cells, which require activation by the growth substances to develop in the uncontrolled fashion characteristic of infection by a virulent crown-gall culture.

Baker (R. E. D.) & Crowdy (S. H.). **Studies in the witches' broom disease of Cacao caused by Marasmius perniciosus Stahel. Part 1. Introduction, symptoms, and etiology.**—*Mem. imp. Coll. trop. Agric., Trinidad*, 7, 28 pp., 18 figs., 10 graphs, 1943.

Cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxii, p. 163] is widespread in and probably indigenous to South America, where it occurs in Brazil, Bolivia, Peru, Colombia, Venezuela, Ecuador, Surinam, and British Guiana. It is also present in Trinidad and Tobago, these islands representing outlying portions of a vast zone of infection centred in the Amazon valley and including the greater part of the cacao-producing areas of South America.

Spread can take place only by means of the spores, which develop in sporophores on dry brooms. Only young, growing tissues are attacked. Both the vegetative shoots and the cushions may become infected, the symptoms produced being variable and confusing. The sort of broom formed depends on the type and age of the infected tissue and probably on the genetic constitution of the tree. A detailed study of sporophore formation in two localities showed that sporophores are never produced on green brooms, and occur on dry ones only after a definite period has elapsed. The duration of this period is of the greatest importance in the control of the disease, since it indicates how often the brooms should be removed annually to keep the disease in check. Normally, brooms become dry five or six weeks after their formation, though this period may last ten weeks. After drying, the average dormancy period before sporophore formation begins is five or six months, but this period is very variable and its length depends chiefly on climatic conditions. The extreme range was 10 to 66 weeks after the brooms had first been observed. Sporophore production, once started, continues (except at the height of the dry season) as long as the broom remains on the tree, or even, under special circumstances, after the broom has fallen to the ground, though after the end of the second year sporophore production becomes considerably reduced. After brooms have fallen from the tree they very seldom produce sporophores, and unless left in heaps, they soon disappear.

Not all brooms produce sporophores. In a dry area where observations were made about 70 per cent. produced sporophores, while in a wet one the figure was about 60 per cent. Large brooms produce many more sporophores than small ones. Chupon brooms and diseased pods are also not very productive of sporophores. Under natural conditions, many brooms remain on the trees for over a year and serve as a dangerous source of spores for a large part of this period. Scars left by fallen brooms behave like the small types of broom. Of 32 scars observed for nine months, 40·6 per cent. produced sporophores, the average number on each being 4·31, as compared with 4·67 for the smallest type of broom.

No positive correlation or precise relationship could be established between weekly rainfall and sporophore production (as gauged by the sporophore index, a figure obtained by dividing 100 × the total number of sporophores produced

during the week by the total number of brooms potentially able to produce sporophores), in spite of the fact that rainfall exercises a controlling influence on sporophore production. In general, sporophore production reaches a peak in the wet season, and is much reduced or altogether inhibited in most of the dry season. It continues at a fairly high rate into the beginning of the dry season. It does not resume full wet-season intensity until some weeks after the onset of the rains, except for a short burst at the oncoming of the wet season. An increase in rainfall generally causes increased sporophore production, but excessive rain may have a depressing effect. Short, dry periods followed by rain stimulate production.

Almost all the sporophores produced in March and April, two very dry months, are formed by brooms which have been producing sporophores for some months, and not by recently developed brooms. Also, no brooms formed during the two final months of the wet season will produce sporophores until after the following dry season, and it makes no difference to the subsequent sporophore production of a broom whether it develops in November or March or any intervening month. This accounts for the fact that brooms formed in November take longer to produce sporophores than those formed between April and August, most of which will have produced sporophores before the dry season checks their development.

No brooms formed in November have been seen to produce sporophores before the dry weather, but in the wet area a few of those produced in October generally do so. In the dry area, no sporophores are produced before the dry weather on brooms developing in October, unless the rains are unduly prolonged. This has an important bearing on control by broom removal, since if this has been thoroughly carried out in October, brooms subsequently formed cannot produce a sporophore before the next wet season, and consequently can safely be left until the main clearance in April.

From October to February, when sporophore production is at a maximum, most of the sporophores are produced on brooms formed in the preceding period of November to February; and as more than 80 per cent. of the annual total of brooms are produced during this period, sporophore production must be very great from October to February. It is to prevent this intense sporophore production, followed by a great development of brooms in January and February, that the routine removal of brooms in April and October is recommended. Brooms formed between March and June reach a high level of sporophore production in the wet season immediately following their formation, but only a few brooms are formed at this season, and they are unimportant from a practical point of view. Brooms formed between July and October may begin sporophore production during the same wet season, but do not attain maximum production until the following wet season. They are most dangerous at the beginning of the rains, before most of the January and February brooms have come into production, and are responsible for most of the infections set up at this time.

Spore deposition depends largely on temperature and generally occurs at night, over a temperature range extending from approximately 57° to 85° F. At 75° germination starts in two hours, and is 95 per cent. complete in four.

Inoculation experiments were conducted in 1941 and 1942 on seven-year-old seedling trees and three-year-old clonal material, using a spore suspension painted on to the trees or applied with an atomizer. Of 247 such inoculations, 61 (26 per cent.) were successful. Of 149 made after the onset of the dry season, only 6 (4 per cent.) were successful, while of 159 made in wet weather 55 (or 35 per cent.) were successful. Failures are attributed to the inoculation of non-susceptible tissues, failure of buds to flush, and unfavourable envirопmental conditions. A fresh spore suspension, young developing buds, and suitable climatic conditions (of a kind not easily reproduced in a greenhouse) are essential. An easy, successful inoculation technique has now been devised, which may prove valuable in testing

for resistance in future breeding work. Climatic conditions are probably more important than has hitherto been realized; on a night when 96 per cent. success was obtained rain fell gently for an hour after the inoculations had been made, and the two occasions when 48 and 50 per cent. successes were obtained both occurred during a very wet spell.

Dealing with control in relation to sporophore formation, the authors state that even a short period at a low relative humidity will destroy the viability of the spores. Apparently, all spores that have not germinated die within 24 hours. This is of considerable practical importance, as it means that infection can occur only so long as an active source of spores exists. There are no resting spores to consider. Unless a spore produces infection during the night it is discharged, it is very unlikely to do so. It is also safe to assume, for quarantine purposes, that material such as budwood will carry no viable spores 48 hours after removal from any source of contamination.

By far the most important factors influencing sporophore production are atmospheric humidity and rainfall. Even prolonged periods of saturation are not enough to initiate sporophore production: rainfall is essential. Visible sporophore initials will, however, complete their development in a saturated atmosphere.

The data obtained showed that a careful removal of brooms by the end of May would reduce the total number of sporophores present the next wet season by 75 to 80 per cent., and that if a second removal were made in October or November, sporophore formation would be almost completely eliminated. Brooms need only be thrown on the ground (not buried or burnt), and as long as they are not piled up in heaps, they will produce very few sporophores. The same holds good for diseased pods and shells. Further, it is very doubtful whether control is helped by removing very small brooms. All brooms over 4 in. long must, however, be removed; and those over 2 in. long should be cut away, if possible.

McLaughlin (J. H.) & Melhus (I. E.). **The response of some field crops on soil treated with chlorpicrin.**—*Iowa St. Coll. J. Sci.*, xvii, 2, pp. 213–220, 1943.

In experiments conducted on two experimental farms in Iowa, the soil was treated with chloropicrin (at the rate of 3 c.c. per injection at staggered 12 in. intervals equivalent to 480 lb. per acre [*R.A.M.*, xxii, p. 131]) in the autumn of 1940 and planted to oats, barley, wheat, rye, flax, cowpeas, lucerne, and sugar beets in the spring of 1941. The treatment had a general beneficial effect upon the germination, the growth of seedlings, and yields. Isolations from diseased root tissue of seedlings grown in the treated soil yield fewer *Pythium de Baryanum*, *P. graminicola*, and other fungi than did those from seedlings grown in untreated soil, and it is probable that the population of soil-borne pathogens was smaller in the treated than in untreated soil. Sugar beet responded strikingly to this decrease and showed 606 per cent. increase in dry weight. Barley showed 450 per cent. increase in yield.

Klages (A.). **Über moderne Saatbeizmittel.** [On modern seed disinfectants.]—*Z. angew. Chem.*, liv, p. 379, 1941. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 150, 1943.]

Far-reaching changes in the chemical structure of seed-grain disinfectants preceded the development of the 'universal' preparations in use to-day against the diseases of all four cereal crops and applicable in either dust or liquid form. The four fungicides of this type officially recognized in Germany in 1940 all contained complex mercury compounds. In the meanwhile, the mercury content, which in 1926 amounted to 16·5 per cent. in the best products, has been reduced, without loss of efficiency, to between 1·25 and 2 per cent. The phenol mercury compounds, e.g., in uspulun, have been replaced by more effective complexes of aliphatic and aromatic hydrocarbons of the type $Hg\langle^{R}_{X}$, in which R is

represented by an alkyl, oxyalkyl, or aryl, and X by a hydroxyl or a single or complex salt-forming anion, such as an acid residue. To the last-named group belong the phenols, dioxybenzols, and pyrocatechol. Both the fungicidal, mercury-containing, electropositive group and the negative acid residue permit of changes influencing surface activity, lipoid solubility, and physico-chemical and biological behaviour.

HOLTON (C. S.) & JOHNSON (A. G.). **Physiologic races in Urocystis tritici.**—*Phytopathology*, xxxiii, 2, pp. 169–171, 1943.

Apart from the discovery by Yu *et al.* that five races of wheat flag smut (*Urocystis tritici*) occur in China [*R.A.M.*, xvi, p. 305], little work has been done on physiologic specialization in this fungus [ibid., xxi, p. 328]. The writers' investigations in 1941–2 were carried out to determine whether the disease in widely separated areas of the United States is caused by one or more races of the smut. Seed-grain of over 100 winter and spring wheat varieties was inoculated with two collections of *U. tritici*, one from Washington and the other from greenhouse material originally obtained from Kansas, and planted in experiment station greenhouses in Washington, Virginia, and Maryland. It was apparent from the divergent reactions of the test varieties to the smut that two races were involved, that from Kansas being designated as 1 and the Washington collection as 2. For instance, the incidence of infection on Oro × Federation 38 and 40 was nil with race 1 and ranged from 59 to 86 and from 29 to 78 per cent., respectively, with 2. These crosses appear to possess the Oro type of reaction, whereas Oro × Federation 1 and 26, like the latter parent, are susceptible to both races.

GORTER (G. J. M. A.). **'Doodgaansiekte', Fusarium-blight or common root rot of Wheat.**—*Fmg S. Afr.*, xviii, 204, pp. 181–183, 2 figs., 1943.

The disease of wheat in the Bredasdorp and Caledon areas of South Africa which is known locally as 'doodgaansiekte' is caused chiefly by *Fusarium graminearum* [*Gibberella zeae*]. It is estimated that in years favourable to infection, some farms sustained losses of up to 30 per cent. of the yield as a result of attack. Injury is greatest in the ear stage. Affected plants show a yellow discoloration a few weeks before harvest time and die early. If any kernels are formed, they are few and shrivelled. The roots show dark brown, shrunken spots, or a uniform, light brown decay. Under moist conditions the base of the stem shows a pink discoloration, and the bottom internode (or the bottom two) are brown. Control consists in seed treatment with copper carbonate or with agrosan or ceresan, the planting of early varieties, and judicious fertilizing of the soil.

CASS-SMITH (W. P.). **The control of loose or flying smut of Wheat (Ustilago tritici).**—*J. Dep. Agric. W. Aust.*, Ser. 2, xix, 4, pp. 236–239, 1 fig., 1942.

In a test made in 1942 for the control of loose smut of wheat (*Ustilago tritici*) seed-grain of the Merredin and Koorda varieties was pre-steeped in water to raise the temperature of the grain to 120° F. as rapidly as possible, then steeped in water at 120° for 95 minutes, and finally immersed in cold water and dried. All seed-grain was treated about six weeks before sowing with an organic mercury dust, to protect any that might have been mechanically injured by the hot-water treatment.

The treated Merredin seed-grain gave 70·5 per cent. germination and no smut, as against 78·6 per cent. germination and 2·1 per cent. smut for the untreated seed, while the corresponding figures for Koorda were (treated) 61·4 per cent. germination and no smut and (untreated) 80·3 per cent. germination and 1 per cent. smut. The depressed germination of the treated seed was partly due, it is thought, to shortage of cold water for the final immersion. During the growing period weaker

seedlings developed from the treated than from the untreated seed, but by flowering time the difference was much less marked.

No affected plants developed in the test plots from the treated seed of either variety, or in the bulk plots where the remainder of the treated seed was sown.

Pre-emergence damping-off of peas has been responsible for many complaints in the metropolitan and adjacent districts of Western Australia. Treatment of the seed with organic mercury and copper carbonate dusts increased germination in infested soil from a mean of 8 per cent. for four varieties to 25 and 53 per cent., respectively. It is recommended that where pre-emergence damping-off has caused poor stands, copper carbonate dust should be applied at the rate of 2 oz. per bush.

Flax rust (*Melampsora lini*) has proved a serious factor to the cultivation of linseed and to a lesser extent of fibre crops. Wild flax (*Linum marginale*) is said to be an important host of the disease. Collections of rusted plants are being made in all the Australian States for the identification of the physiologic races involved and for breeding purposes.

Teakle (L. J. H.). **Experiments with micro-elements for the growth of crops in Western Australia. VI. Further results from the use of copper-containing fertilizers in the Wheatbelt.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xix, 4, pp. 242–253, 2 figs., 1 map, 1942.

To obtain further information on the occurrence and cure of copper deficiency on wheat soils in Western Australia [cf. *R.A.M.*, xxii, p. 17], a number of experiments were carried out locally in 1941 with copper-containing fertilizers, and inquiries were also made of farmers who had tried such fertilizers. Some of the experiments gave beneficial results, but not others, and about one-third of the farmers who had used copper sulphate as a fertilizer reported satisfactory results.

The types of country likely to be acutely deficient in copper for cereal crops are detailed, and the opinion is expressed that the use of fertilizers containing copper will correct the deficiency. An annual application is not highly important if 5 to 10 lb. of copper sulphate per acre are used with the first dressing, as such applications have remained effective for several years.

Nattrass (R. M.). **'Take all' disease of cereals (Ophiobolus graminis).**—*E. Afr. agric. J.*, viii, 3, pp. 133–135, 1 fig. (facing p. 136), 1943.

After stating that wheat take-all (*Ophiobolus graminis*) has long been present in Kenya [*R.A.M.*, xix, p. 76], where it has occasionally caused serious loss, the author briefly describes the symptoms of the disease and succinctly reviews recent investigations on the fungus. As the form attacking oats is not likely to be present in Kenya, it is thought that oats can safely be grown after an affected wheat or barley crop. Where the altitude allows of it, maize may safely be alternated with wheat. *Lolium temulentum*, which occurs locally on cultivated land, is affected, and may harbour the fungus.

In conclusion, it is stated that the condition is more likely to be troublesome on light than on heavy soil; a firm seed-bed is essential, the ploughing-under of resistant plant residues being undesirable; if the disease is known to be present, two wheat crops should not be taken in succession, particularly on light soils; grass weeds on fallows and among other crops should be kept down; and the organic content of the soil should be maintained, and superphosphate applied.

Oort (A. J. P.). **De vatbaarheid voor stuifbrand van in Nederland verbouwde of beproefde rassen van Tarwe en Gerst.** [The susceptibility to loose smut of the Wheat and Barley varieties cultivated or tested in Holland.]—*Meded. Landb-Hoogesch. Wageningen*, xliv, 8, 54 pp., 1940. [English summary. Abs. in *Z. PflKrankh.*, lii, 12, pp. 547–548, 1942.]

The reactions of wheat to *Ustilago tritici* and of barley to *U. nuda* were deter-

mined by means of an inoculation procedure devised by the author in comparison with spontaneous infection, the former method possessing various advantages besides that of inducing a high incidence of disease. It should be noted that fairly low temperatures during the early growth stages of the host tend to suppress loose smut infection, so that for testing purposes winter and summer varieties should be sown somewhat earlier and rather later, respectively, than the normal dates. A reasonably high proportion of the winter wheat varieties tested, comprising diverse types of differing origin, proved resistant to *U. tritici*, while the summer group also included a number of sorts capable of withstanding loose smut. On the other hand, none of the barley varieties used in the trials showed any noteworthy degree of resistance to *U. nuda*. It was confirmed that *U. tritici* is not communicable to barley or *U. nuda* to wheat. Strict specialization exists within both smuts, the races of which attacking the winter varieties of wheat and barley are physiologically and pathogenically distinct from those encountered on the summer crops. In the case of wheat there are numerous resistant varieties of which use can be made in breeding experiments, but no such possibility exists in connexion with barley, so that the development of resistance in the latter therefore presents difficulties.

Jørgensen (C. A.). **Symptoms of potash deficiency in cultivated agricultural plants and their use for the detection of a potash deficiency in the soil.**—*Tidsskr. Planteavl*, xliv, pp. 557–633, 1940. [Abs. in *Chem. Abstr.*, xxxvii, 6, p. 1552, 1943.]

In Denmark symptoms of potash deficiency in barley are expressed mainly in white speckling of the leaves, necrosis of portions of the foliar tissue of varying extent also affecting this crop, clover, and swedes, while oats show a discoloration of the entire plant. The whitish-yellow specks on barley are particularly valuable as indications of a potash shortage which can be corrected by top-dressing. The effects of potash deficiency were more noticeable on crops following oats, swedes, and *Scleranthus* grass than on those succeeding barley, fodder or sugar beets, and timothy [*Phleum pratense*]. Analysis of the leaf spots revealed a marked deficiency of potassium.

Scharrer (K.). **Versuche über die Brauchbarkeit einer in der Norddeutschen Affinerie Hamburg anfallenden Kupferschlacke als Düngemittel.** [Experiments on the utilization as a fertilizer of a copper slag from the North German Refinery, Hamburg.]—*Forschungsdienst*, xiii, pp. 33–44, 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 148, 1943.]

The author reports the results of co-operative investigations undertaken by the Prussian Marsh Experiment Station, the Fodder Cultivation Institute, Kiel, the Oldenburg Agricultural Experiment Station, and the Phytopathological Institute of the University of Bonn, to determine the efficacy of the copper slag collected from the North German Sugar Refinery in the control of reclamation disease [of cereals, mainly oats, and other crops: *R.A.M.*, xx, p. 352; xxi, p. 134]. Although the product in question did not equal copper sulphate in its beneficial effects on the affected plants, it proved to be quite a useful remedy, used after intensive mechanical pulverization at a minimum dosage of 900 kg. per ha., in relatively mild cases of the disease, its value as a fertilizer being enhanced by its high lime content and numerous trace elements. Fears that the arsenic and lead contents of the slag would exert an adverse effect on the crops were not realized, while the assumption that the phosphoric acid in the soil would be fixed by its iron constituent likewise proved to be erroneous. The utility of the Hamburg slag for reclamation disease control is stated to be surpassed by other copper residues, e.g., that of a Hessian shale, which approximates to copper sulphate in its curative action.

Chapman (H. D.) & Brown (S. M.). **Potash in relation to Citrus nutrition.**—*Soil Sci.*, lv, 1, pp. 87–100, 4 figs., 1943.

This is an expanded, tabulated account of work which has already been noticed from another source [*R.A.M.*, xxii, p. 63].

Chapman (H. D.) & Brown (S. M.). **Some fungal infections of Citrus in relation to nutrition.**—*Soil Sci.*, liv, 4, pp. 303–312, 4 figs., 1942.

In connexion with their studies of citrus in sand and solution cultures at the Riverside Experiment Station, California, the writers have observed a number of cases of parasitic diseases induced by nutritional conditions, two of which are reported in some detail. Four-year-old Navel and Valencia orange trees on sour orange rootstock growing out of doors in solution cultures of high potassium–low calcium content (10·02 : 3·14 milliequivalents per l.) developed brown-rot gummosis, *Phytophthora parasitica* being isolated by L. J. Klotz both from the obviously diseased roots and from those in another series of tests with a more favourable potassium–calcium balance. The Navel orange fruits in the high potassium–low calcium series showed a certain amount of water spot [*R.A.M.*, xvii, p. 671] on the rinds and considerable infection by *Alternaria citri*.

In a similar outdoor solution-culture experiment with Navels on sour orange rootstocks, the roots of the plants supplied with medium- and high-phosphate levels (1·5 to 5 m.e. per l.) contracted severe infection by *Thielavia* [*Thielaviopsis*] *basicola*, which occurred only in a mild form in the low-phosphate (0·10 m.e.) series. In all these cultures the hydrogen-ion concentration had been maintained close to P_H 5: when it was adjusted to a more acid reaction (3·5), the growth of the fungus was arrested, and the new roots developing subsequent to this alteration remained healthy [cf. ibid., x, p. 762].

These observations may be of some practical significance in relation to citrus disorders in California, where the soils of many old orchards contain heavy accumulations of phosphate and potassium through the continuous use of manures and mixed fertilizers.

Mackie (J. R.). **Annual Report, Agricultural Department, Nigeria, 1941.**—10 pp., 1942. [Mimeographed.]

Remarkable improvement has followed the treatment of oil palms affected with 'yellowing disease' [cf. *R.A.M.*, xx, p. 7] in Nigeria with wood ash, a complete cure having resulted, apparently, in many cases. The method is not yet, however, recommended to growers.

Rogers (C. H.). **Cotton root rot studies with special reference to sclerotia, cover crops, rotations, tillage, seeding rates, soil fungicides and effects on seed quality.**—*Bull. Tex. agric. Exp. Sta.* 614, 45 pp., 12 figs., 1942.

This bulletin presents the results of experimental work on cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xxii, p. 135] conducted at the Blackland Experiment Station, Temple, Texas, from 1931 to 1942. Viable sclerotia of the causal fungus were found in cultivated and uncultivated soil to a depth of 8 ft.; the largest numbers, reaching several millions per acre, occurred in the first 3 to 4 ft. of soil. Under the microscope, viable sclerotia were found to have a relatively thin epidermis of thick-walled cells and a dense cytoplasm in the homogeneous cells of the interior, whereas the non-viable sclerotia had a thicker epidermis and a less dense cytoplasm in the internal cells. In plots with crop rotations and green manuring the number of sclerotia was reduced in comparison with those continuously planted to cotton, but this reduction is considered insufficient to explain the partial control of root rot obtained by these practices. It is suggested that the beneficial

effect may be exercised on the active stage of the fungus in the soil or directly on the host plant.

The root-rot fungus was found to parasitize plants of *Hemerocallis* sp. and *Tradescantia* sp., causing the typical penetration and destruction of root tissues. Of the legumes found adaptable under local conditions for purposes of green manuring, *Sesbania* and guar (*Cyamopsis tetragonoloba*) proved to be highly resistant to root rot, and certain selections of Brabham and Iron cowpeas relatively so.

In crop-rotation trials, cotton-maize-oats rotation with cowpeas or sorghum ploughed under for green manuring in late summer after oats, resulted in an increase of 100 lb. per acre in the yield of lint cotton and a decrease by 20 to 30 per cent. in the amount of root rot, as compared with data from continuous cotton plots. Similarly, the yields of cotton following the ploughing-under of Hubam clover stubble (after harvesting the crop for hay or seed) was twice as large or larger than in continuous cotton plots, and the amount of root rot reduced from 70 to 15 or 20 per cent.

Subsoiling to depths of from 15 to 30 in. was found to give consistent reductions in the amount of root rot, but did not increase yields sufficiently to justify the expense entailed. Ploughing-under of cotton stalks immediately after picking, and while they are still green, reduced root rot and increased the yields of cotton; no additional benefit resulted from the supplementary treatment with 120 lb. nitrogen per acre.

In a three-year study, in which cotton seed was planted at rates of 2, 5, and 10 seeds per hill, in hills 18 in. apart, and the stands later thinned out to not more than two plants per hill in all plots, the lowest percentage of root rot and comparatively high yields were observed in plots with the fewest seeds per hill. Cotton plants killed early in the season by root rot were found to produce hardly any crop and their seed to have a lower oil and protein content and a lower viability than seed from plants which succumbed to root rot later in the growing season.

Soil treatment with crude oil, applied at a depth of 12 or 18 in. at rates of from 1,000 to 15,000 gals. per acre, considerably reduced root rot and increased cotton yields. In tests with various fungicides, a combination of copper sulphate, iron sulphate, and soil sulphur (2 oz. of each of the materials per cu. ft. of soil) was most effective in controlling root rot and chlorosis in roses.

SYLVÉN (N.). **Cordyceps militaris Fr. på Dasychira pudibunda (L.).** [*Cordyceps militaris* Fr. on *Dasychira pudibunda* (L.).]—*Bot. Notiser, 1942*, pp. 97–98, 1 fig., 1942. [Abs. in *Z. PflKrankh.*, lii, 12, pp. 546–547, 1942.]

In association with severe infestation by the Lymantriid, *Dasychira pudibunda*, in a beech forest in the Konga district of Scania (Sweden), *Cordyceps militaris* [*R.A.M.*, xviii, p. 507] was observed in profusion, several pupae being attacked over almost every square yard. The considerable practical value of the fungus for the destruction of the larvae and nymphs of several noxious moths is emphasized. The present find constitutes a new station of *C. militaris* for Sweden.

ASHBURN (L. L.) & EMMONS (C. W.). **Spontaneous coccidioidal granuloma in the lungs of wild rodents.**—*Arch. Path.*, xxxiv, 5, pp. 791–800, 3 figs., 1942.

Of 105 rodents trapped in the desert round San Carlos, Arizona, nine showed gross pulmonary lesions (granulomatous nodules), mostly situated in the lower lobes of the lungs, viz., seven pocket mice (*Perognathus*), one kangaroo rat (*Dipodomys*), and one ground squirrel (*Citellus*). Fungi were present in all the lesions, ranging from 4 to 50 μ in diameter, the larger forms (upwards of 20 μ), however, being uncommon. The cells were provided with doubly contoured walls and varying amounts of lightly basophilic, irregularly and finely vacuolated cytoplasm, containing in some cases small, fairly well-defined, deeply basophilic granules. Two of the nodules from two pocket mice harboured six fungal cells which had

reached the stage of maturity coinciding with the assumption of the reproductive functions of sporangia: they measured 23 to 50 μ in diameter and showed distinct endosporulation. The progressive cytoplasmic cleavage and the shape of the endospores were characteristic of the developing spherules of *Coccidioides immitis* [*R.A.M.*, xxi, p. 333] as observed in human and experimental infections. The endospores formed a peripheral layer below the doubly contoured wall and encircled a large central vacuole, which was absent, however, from one completely ripe sporangium entirely occupied by small spores. Besides these fungal elements, varying numbers of cells of slightly different appearance and staining reactions were found scattered through the lungs of all the above-mentioned animals except the kangaroo rat, and in eight of another 13 rodents examined which showed no granulomatous involvement. The relationship of these forms to those within the nodules and to the fungi isolated from the animals is still under investigation [see next abstract].

EMMONS (C. W.) & ASHBURN (L. L.). **The isolation of Haplosporangium parvum n. sp. and Coccidioides immitis from wild rodents. Their relationship to coccidioidomycosis.**—*Publ. Hlth Rep., Wash.*, lvii, 46, pp. 1715–1727, 4 pl., 1 fig., 1942.

Continuing their studies on the fungus accompanying *Coccidioides immitis* in the lungs of some desert wild rodents and occurring independently in others [see preceding abstract], the writers here describe it as a new species of *Haplosporangium* under the name of *H. parvum*. It is characterized on acid dextrose agar by a delicate, matted, white, later brownish mycelium, sparsely septate hyphae averaging about 1, rarely attaining 4 μ in diameter, slender conidiophores, either simple, 0·5 to 4 μ in length, or branched, 1·1 by 0·5 μ, and spherical or subspherical, minutely echinulate, subsequently smooth conidia, 3 to 3·5 μ in diameter, containing one or more hyaline bodies. In the host tissues the organism occurs in the shape of spherical, non-budding cells up to 14 μ in diameter, the species affected being *Perognathus baileyi*, *P. penicillatus*, and *P. intermedius*, *Dipodomys merriami*, *Citellus harrisi*, *Onychomys torridus*, and *Peromyscus eremicus* (92 specimens in all, exclusive of the nine mentioned in the previous paper, in which *Coccidioides immitis* was also present).

Evidence from skin tests on school-children suggests an antigenic relationship between the two fungi under discussion, while a genetic connexion is indicated by the circumstances of their isolation, their resemblance in the host tissues, and the results of laboratory studies. Possibly the relatively avirulent *H. parvum* may be a mutant of *C. immitis* arising under desert conditions or developing when the spores of the latter are inhaled by comparatively resistant animals. Should this supposition be verified, a hitherto unrecognized point of attachment between *C. immitis* and the Phycomycetes would be provided, while attention should also be drawn to some striking cultural affinities between *H. parvum*, *Blastomyces dermatitidis*, and *Histoplasma capsulatum* (Fungi Imperfecti).

JENKINS (ANNA E.). **Additional records of Violet scab.**—*Phytopathology*, xxxiii, 2, pp. 168–169, 1943.

Violet scab (*Sphaceloma violae*) is now known to occur in South Africa, New South Wales [*R.A.M.*, xviii, p. 373], and the following States of the American Union: New York, Pennsylvania, New Jersey, Maryland, Virginia, South Carolina, Georgia, Florida, Alabama, District of Columbia, Massachusetts, Connecticut, North Carolina, Mississippi, and Texas, the species of *Viola* susceptible to the fungus including *V. jooi*, *V. priceana*, *V. vilmoriniana*, and *V. cucullata*.

CHILTON (S. J. P.). **Variations in sporulation of different isolates of Colletotrichum destructivum.**—*Mycologia*, xxxv, 1, pp. 13–20, 2 figs., 1943.

The nature of the loss of sporulation commonly observed in *Colletotrichum*

destructivum was studied in 14 single-spore cultures of this fungus isolated from *Trifolium repens*, its var. *ladino*, *T. pratense*, and *T. hybridum* in Pennsylvania in 1938. Transfers from the original cultures, made after six weeks or more, often produced sectored growth in plates of agar and a white, fluffy mycelium in tubes. Single-spore cultures made from such sectors or fluffy patches differed from the original cultures, some producing more and others less spores than these. As many as 15 distinct variants were obtained from one original culture. The original cultures were found to retain their ability to sporulate and other cultural characteristics through ten successive single-spore generations. Transfers to sterilized host tissue and to the living host did not help poorly sporulating cultures to regain their ability to sporulate. Two variants were isolated from lesions of sterile red clover seedlings previously inoculated with a single-spore culture of the fungus. Conidia were predominantly uninucleate, only a few containing two nuclei. It is concluded from these data that the loss of sporulation in cultures of *C. destructivum* is due to the occurrence of poorly sporulating variants genetically different from the original type which they replace.

Loftus Hills (K.). **The reaction of varieties of Trifolium subterraneum to leaf rust (Uromyces trifolii (Hedw.) Lév.).**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 272–274, 1942.

During the late spring of 1941, 46 varieties of *Trifolium subterraneum* being grown experimentally at Moss Vale, New South Wales, developed a heavy epidemic of leaf rust (*Uromyces trifolii*), and observations were accordingly made on the amount of infection present in the various varieties. As seed of many of these varieties had been sown at Canberra, where a minor epidemic of leaf rust also occurred, notes on the infection present there were obtained, from one replication, using a very similar infection grading.

The results are tabulated, together with the leaf rust resistance for these varieties as estimated by Levy and Gorman (*N.Z. J. Agric.*, liv, pp. 82–94, 1937), and Radel's classification (*Tasm. J. Agric.*, N. S., vi, pp. 16–24, 1935), and do not in all instances agree. Thus, at Moss Vale, Tallarook was heavily infected, but at Canberra it was only slightly attacked, while Levy and Gorman and also Radel placed it in the resistant group. Both Dwalganup and Mulwala showed greater relative infection at Palmerston North in Levy and Gorman's tests than at Moss Vale or Canberra, while there was definite evidence that at Moss Vale Dwalganup was more susceptible than Mulwala. Bacchus Marsh was heavily attacked at Moss Vale but remained unaffected at Canberra, and showed only slight infection in the other workers' tests (at Palmerston North and in Tasmania). All four sets of figures, however, agree as to the high susceptibility of the Mt. Barker variety and the resistance of Wenigup. Mulwala and Second Northam also showed no infection at Moss Vale.

There seems to be no general correlation between relative maturity and resistance, though there is a possibility that the early varieties may owe some of their apparent immunity to the fact that their growth had all but ceased when the epidemic broke out. In some instances the Moss Vale data show significant differences in susceptibility between different lots of one and the same variety. Some of this variation may be due to differences in maturity, but, on the other hand, actual differences in resistance perhaps exist between different lines of one variety.

Apparent differences in susceptibility of a variety at different places may be due to one or more causes, i.e., different physiologic races of the fungus, different lines of the host varieties, interaction between infection conditions and varietal susceptibility, or differences in the relative stages of growth when the epidemics occurred. In spite of these variations, it is clear that reaction to leaf rust of

the known varieties of *T. subterraneum* varies from highly resistant to highly susceptible.

SHILO (Y. M.). **The molding of feeds and its prevention.**—*Nauch. Zap. ukr. sel.-khoz. Univ.*, i, pp. 179–192, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxvii, 5, p. 1204, 1943.]

Analyses of the chemical compositions of lucerne hay and barley infected by *Aspergillus fumigatus* indicated losses of nutritive substances, amounting in the latter crop after 60 days at 37° C. to 29·3 and 86·6 per cent. for crude protein and non-nitrogenous extractable substances, respectively. The mould develops on fodders during storage at a relative humidity of 60 per cent. Extracts obtained by Bodin and Lenormand's method from fodders infected by *A. fumigatus*, *A. niger*, *A. glaucus*, and *A. nidulans* proved highly toxic to rabbits and rats, especially in the case of lucerne.

DIPPENAAR (B. J.). **The control of deficiency diseases in plants.**—*Fmg S. Afr.*, xviii, 204, pp. 189–194, 4 figs., 1943.

IN the western Cape Province, South Africa, zinc deficiency has so far been found to affect only fruit trees, particularly plum, peach, and apple, in which it produces little leaf [*R.A.M.*, xx, p. 368]. Pear, apricot, and citrus are slightly affected. In addition to the usual symptoms, in, for example, severely affected peach trees, apparently normal leaves develop a yellow discoloration of the tissue between the veins before the end of the growing season. This is termed 'mottle leaf', and is very prevalent in citrus trees, in which little leaf is rather exceptional.

This disease causes the loss of more fruit trees in the winter-rainfall area than any other, fungal and bacterial troubles included. It also attacks a wider range of fruit trees than any other widely known disease.

Growers must exercise great care when applying lime. In normal times, when ammonium sulphate is available, the application of this form of nitrogen will, in the course of years, increase soil acidity, and make the zinc present more readily available to the trees. Affected peach, apricot, pear, and apple trees should be treated with zinc sprays as soon as they come into full leaf, i.e., in western Cape Province, peaches and pears should be sprayed in October and November, and apples in December. Winter spraying of these varieties was less effective than summer spraying, but with plums it was more effective than spring or summer spraying. Citrus trees should be sprayed in spring as soon as the new growth appears but before the blossoms open. For the winter spraying of plums 20 to 50 lb. zinc sulphate per 100 gals. of water are used; lime is essential in spring spraying to prevent leaf burn, and the formula recommended is 10 lb. zinc sulphate and 5 lb. best-quality slaked lime per 100 gals. water for peach, apricot, and citrus trees; 15 lb. zinc sulphate and 7½ lb. lime for apples and pears. These mixtures entail no risk of leaf burn in dry weather.

Manganese deficiency symptoms are generally referred to as mottle leaf [loc. cit.]. The usual symptoms are not noted on citrus trees. Leader shoots die back, but show no little leaf. Severely affected peach trees give very poor yields.

Locally, manganese deficiency is more prevalent than zinc deficiency, affecting numerous vegetables, fruit trees, and ornamental plants [ibid., xxi, p. 467]. Plants (e.g., peach and citrus) sometimes show signs of lack of both zinc and manganese, and require to be treated for both conditions.

Thorough tests have shown that the following treatments against manganese deficiency can be recommended. Peach, apricot, plum, apple, and citrus must be sprayed with 2½ lb. commercial manganese sulphate per 100 gals. water, directly they come into full leaf and show symptoms of the trouble. Severely affected plums may require a second spray application four to six weeks later. Peach trees that

bear poorly as a result of manganese deficiency must receive an extra winter spray about six to eight weeks before blossoming, 10 to 15 lb. manganese sulphate per 100 gals. water being used. The weaker solution is used for vegetable crops, which should be given two or three applications at intervals of 14 days to three weeks. Potatoes twice sprayed with this yielded 115·75 lb., as against 21·25 lb. for the untreated controls, while beans [*Phaseolus vulgaris*] sprayed three times with a ¼ per cent. manganese sulphate solution yielded 7,184·5 gm. (dry weight), as against 1,939·5 gm. for the untreated controls. If stable manure is applied to vegetable soils deficient in manganese, the results are at least as good as those obtained where only fertilizers are applied and the plants sprayed with manganese. Seed beans and potato tubers grown in manganese-deficient soil will give symptoms even if planted in normal soil, and should be soaked in a ¼ per cent. manganese solution for four to six hours immediately before planting.

Symptoms of both zinc and manganese deficiency were removed from orchard trees by spraying with 10 lb. zinc sulphate, 5 lb. manganese sulphate, and 7½ lb. slaked lime per 100 gals. water.

A zinc-lime mixture, as recommended for early summer spraying, gave excellent results against leaf rust [*Puccinia pruni-spinosae*] of apricots and peaches, while a manganese-lime mixture was ineffective. On mandarin trees, however, zinc-lime or zinc-manganese-lime was much less effective than Bordeaux mixture against leaf and fruit spot due to *Macrosporium* sp.

Spraying schedules, 1942.—*Proc. N.Y. St. agric. Soc., 1942*, pp. 361–382, [1942].

Spraying schedules drawn up by the Agricultural Experiment Stations at Geneva and Ithaca, New York, are given for apples, pears, cherries, peaches, plums, quinces, and vines.

STODDARD (E. M.) & HEUBERGER (J. W.). **A simple rapid method of field testing fungicides on Apples.**—Abs. in *Phytopathology*, xxxiii, 1, p. 13, 1943.

The writers' method of testing fungicides on apple trees involves the use of young standards, planted 10 by 10 ft. (435 to the acre), thereby economizing in land, time, and labour. By this arrangement, spraying operations can be carried out with hand equipment and a number of preparations tested simultaneously, while data on control, injury, dosage, timing, or other points of interest are more easily obtainable than on large trees, and replication of plots is easily arranged. The inoculum, e.g., overwintered leaves infected by scab [*Venturia inaequalis*], can be uniformly distributed with a corresponding regularity in the incidence of attack. Data collected over a protracted period reveal a direct correlation between scab control on the foliage and on the fruit, so that the test materials are rated in the same order in respect of both organs. However, if fruit is expressly required for the purposes of an experiment, dwarf trees may be substituted for standards. This method would be similarly applicable to other foliar diseases of fruit trees, such as cherry leaf spot [*Coccomyces hiemalis*], *Bacterium* [*Xanthomonas*] *pruni* on peach, and cedar rust of apple [*Gymnosporangium juniperi-virginianae*].

KEITT (G. W.) & MOORE (J. D.). **Experiments with eradicant and protectant sprays for Apple scab control in 1942.**—Abs. in *Phytopathology*, xxxiii, 1, p. 6, 1943.

The 'floor' of 40 acres on one side of a 60-acre apple orchard [in Wisconsin] was treated against scab [*Venturia inaequalis*] at bud-break with elgetol [*R.A.M.*, xxii, p. 144] at a strength of 0·5 per cent. and a dosage of 600 gals. per acre. Various protectant spray programmes were tested on randomized, replicated, single-tree McIntosh plots repeated in blocks I (ground-treated, more remote from non-ground-treated), II (ground-treated, intermediate), III (non-ground-treated) in all of which

some of the applications (usually numbering eight, three before and five after bloom) were unavoidably poorly timed, and IV, situated essentially as I but treated at the proper time. In blocks I to III the lime-sulphur spray 20 days after petal-fall was omitted. The disease occurred in a very severe form during the period covered by the trials. Spore discharge studies showed that ground treatment reduced ascospore inoculum by 99 per cent. Counts made a fortnight after petal-fall indicated that unsprayed trees in block I bore 87 per cent. fewer lesions than those in III. In ground-treated block I the percentage of infected fruits at harvest ranged from 11 for lime-sulphur to 19 for kolofog (after bloom, following lime-sulphur), while in non-ground-treated III the corresponding incidence was from 26 to 77 per cent. The well-timed lime-sulphur schedule in ground-treated IV permitted the development of only 2 per cent. scabbed fruit.

Shay (J. R.). **Genetic studies of certain mutant characters in Venturia inaequalis.**—Abs. in *Phytopathology*, xxxiii, 1, p. 11, 1943.

Several cultural mutants of *Venturia inaequalis* [*R.A.M.*, xxi, p. 208] were found to carry factors for partial or entire ascopore abortion, the former represented by the development of uni- or bicellular, misshapen, colourless, sometimes viable spore-like structures, and the latter by a complete absence of spore differentiation. Three mutants arising as white or pinkish-white sectors in culture transmitted factors for ascospore abortion. In 114 asci studied from a cross involving one such sector, white (W), normal (w), the four aborted ascospores of any ascus, when viable, uniformly gave rise to white cultures, whereas those produced by the four normal ascopores were normal, indicating that ascospore abortion and white colour result from the same mutation. White (W) was found to be closely associated in the same chromosome arm with another mutant of a tan (T) colour, which produced eight-spored asci in matings with normal (t). Another mutant, non-conidial (Nc), was located in relation to the centromere, but is probably not linked with tan. The sex factor appears to be situated at a considerable distance from the centromere, and there is thought to be no linkage between it and the white factor.

Van De Pol (P. H.). **Onderzoek naar het beste tijdstip der voorjaarsbespuiting tegen Appel- en Perenschurft (Venturia inaequalis (Cke) Wint. en Venturia pirina Ad.).** [An investigation on the most effective date for the spring treatment against Apple and Pear scab (*Venturia inaequalis* [Cke] Wint. and *Venturia pirina* Ad.).]—*Tijdschr. PlZiekt.*, xlvii, pp. 197–230, 1941. [Abs. in *Z. PflKrankh.*, liii, 1–3, pp. 149–150, 1943.]

In the spring of 1941, overwintered stromata of apple and pear scab (*Venturia inaequalis* and *V. pirina*), especially the latter, with mature conidia, were detected on inadequately sprayed trees even before the appearance of the first ascospores, but they were of comparatively slight importance in the establishment of primary outbreaks of the diseases. The stage of bud development is not considered to afford a suitable basis for the determination of the correct spraying date. By an adaptation of Speyer's method for the calculation of egg maturation in *Psylla mali*, the author computed that at Wageningen the first perithecia ripen when the sum-total of the temperatures prevailing from 7th February onwards reaches 285 to 289° [C.]. By this means it is possible to reckon the date by which the preliminary spring treatment should be given, while the period of ascospore discharge can be predicted from the appearance of the first free ascospores on the perithecia-bearing fragments of leaf tissue wetted daily in the laboratory. Practical applications of these principles were successfully made in various parts of Holland, and it is expected that the determination of correct spraying dates will lead to a substantial reduction in the annual losses from apple and pear scab, which are estimated at 15 per cent. of the crops, corresponding to a monetary value of Fl. 4,500,000.

CUMMINGS (M. B.) & DUNNING (R. G.). **Bitter pit of Apple. I. In orchard and in storage.**—*Bull. Vt agric. exp. Sta.* 467, 30 pp., 5 pl., 1940. [Received April, 1943.]

The first instalment of the authors' studies on bitter pit of apple briefly reviews the history and literature of the disease, describes observations, and presents twelve years' data obtained in the Experiment Station orchard and elsewhere in Vermont, and discusses the development of the disorder in storage at different temperatures, based on the results of three years' tests. The first record of bitter pit in Germany dates from 1869, since when it has been found in most of the apple-growing regions of the world, having been detected in Vermont from 1891 onwards. The etiology of the disease is still obscure, either an unbalanced nutritional condition, an irregular water supply, or both being possible causes, while the problem of control likewise remains unsolved.

Only four or five of the 40 varieties cultivated at the Experiment Station suffer severely from bitter pit, Arctic, Baldwin, Northern Spy, and Shiawassee being the most susceptible, but some half-dozen others have been found to develop the trouble to a limited extent in various parts of the State. A striking feature of bitter pit is its erratic occurrence, a tree showing virtual freedom from the disease in one year being heavily pitted in the next. Again, trees of the same variety in close proximity may develop extensive pitting at harvest and little in storage or vice versa. The condition is much more troublesome at harvest time in some seasons than in others, injury having been slight in 1931, for instance, and severe in 1936. These discrepancies may have been due to the differences in the rainfall distribution in the two years: in the former, after a wet June a dry spell supervened until mid-September, while in the latter, the rainfall was mainly concentrated in the late summer. In 1936 the average incidence of pitting in nine Arctics in the orchard was 38·8 per cent. and in storage from 18th September to the following 26th January 74·8, the corresponding figures for harvest, 1937, and storage from October to the following January being 1·6 and 18·2 per cent., respectively, and for harvest, 1938, and 10th January, 1939 (after storage since 18th November), 2·6 and 39·3 per cent., respectively.

Bitter pit develops most rapidly during the first two or three months of storage, its progress usually being arrested after midwinter, so that the healthy fruit can be separated from the diseased and sold.

Fruit from the 1937 crops of nine Arctics (1,207) and eight Spys (601), passed as perfect in January, 1938, were held in cold storage until mid-April, when the apples of the former variety were still in sound condition, whereas 2 per cent. bitter pit was detected in the fruit from three of the Spys and 5 per cent. in the lot from another tree of the same variety.

LEWIS (F. H.). **Is there danger of reducing the set of fruit by blossom-time sprays or dusts for control of scab, rust, or fire-blight?**—*Proc. N.Y. St. agric. Soc., 1942*, pp. 15–24, [1942].

Experiments carried out in New York State from 1939 to 1941, inclusive on 12- to 20-year old apple trees, to determine whether spraying or dusting against scab [*Venturia inaequalis*], rust [*Gymnosporangium* spp.], or fire-blight [*Erwinia amylovora*] during bloom exercised a deleterious effect on fruit set are described.

In 1939, a single sulphur dust application of 1 or 2 lb. per tree to McIntosh apples when 25 to 30, 50 to 60, 75 to 80, and one day after 75 to 80 per cent. of the flowers had opened gave, respectively, 12·4, 11·4, 11·4, and 17 fruits per 100 flower clusters in August, as against 18·1 for the untreated control. Trees of the same variety dusted 0, 1, 2, 3, and 7 times showed, respectively, 20·8, 17, 10·2, 9·3, and 9·1 fruits per 100 flower clusters in August. Pollination conditions were poor in this orchard.

In another, of the same variety, where these conditions were good, the trees were given a single application of 4 gals. per tree lime-sulphur (1–80) and flotation sulphur paste (6·5 [lb. per 100 gals.]) during full bloom. These treatments gave, respectively, 31 and 38 fruits per 100 flower clusters in August, as against 47 for the untreated control.

Similar results were obtained in further experiments [which are described] in 1940 and 1941, and it is concluded that spraying or dusting apple trees during bloom with the materials used in the experiments cited will reduce fruit set in many cases. Lime-sulphur appeared to cause the heaviest and sulphur the least injury.

Before deciding to apply bloom treatment, growers should first make sure that it is necessary. Apple fireblight [ibid., xxi, p. 530] can be partially controlled by the application of Bordeaux mixture or copper-lime dust during bloom. In those orchards where infection has been destructive, the possible reduction in fruit set and the danger of fruit russeting are less important than the disease, and bloom applications are probably justified. Where, however, infection has not been serious, bloom treatment may cause heavier loss than the disease.

HILDEBRAND (E. M.) & PALMITER (D. H.). **How to prevent destruction of New York State Peach orchards by the new yellow-red virus disease.**—*Proc. N.Y. St. agric. Soc., 1942*, pp. 34–40, [1942].

After referring to the early spread of 'X' disease or yellow-red virosis of peaches in New York State [*R.A.M.*, xx, p. 310; xxi, p. 147], the author points out that the steps taken to ensure that all new peach plantings were properly isolated from chokecherries [*Prunus virginiana*] have resulted in not one case of the disease being found in nursery peach trees in the whole State.

There can be no doubt that the disease is spread by some insect, which feeds on chokecherries. The disease spreads to peaches only when affected chokecherries are within a distance of about 200 ft. The usual sequence of events is a diseased chokecherry at the edge of a peach orchard one year, and diseased peaches the next. In the eastern areas of the United States, 'X' disease always spreads from chokecherry to peach, no case of spread from peach to peach having been found. If affected chokecherries are removed 200 ft. or more from an orchard, further spread between peach trees ceases. The western form of the trouble [ibid., xxii, p. 32] does, however, spread from peach to peach.

Growers starting new orchards should plant disease-free trees at a distance of 500 ft. or more from chokecherries, and if possible remote from all other wild species of *Prunus*. Where orchards in production are bordered by chokecherries, these must be killed or otherwise disposed of. Peach trees become worthless three years after infection, and can then be removed.

After many years' tests with chemical eradicants the best results in chokecherry removal were given by a spray consisting of $\frac{3}{4}$ lb. sodium chlorate in 1 gal. water. A single application in June is all that is required. Very good results have also been obtained with ammonium sulfamate, used at the same concentration, which has the advantage of not being inflammable. With shrubs up to 4 ft. tall, 1 gal. of either mixture will cover an area of about 100 sq. ft. Taller shrubs require additional spray up to 2 gals. for the same area. Cutting off the tops of the chokecherries is inadvisable as these herbicides act more effectively on woody than on succulent growth.

The risk of introducing the disease in propagating budwood or root stocks can be eliminated by exposure in a water bath to a temperature of 122° F. for six to ten minutes, which inactivates the virus. Experiments have confirmed Stoddard's finding that nectarine, almond, wild Bessey cherry [*P. besseyi*], and wild Hortulana plum [*P. hortulana*] are susceptible [ibid., xxi, p. 28], and will, it is expected, add other plants to the list of suscepts.

IMPERIAL MYCOLOGICAL INSTITUTE

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SCHØYEN (T. H.) & JØRSTAD (I.). **Skadedyr og Sygdommer i Frukt- og Baerhagen.** [Pests and diseases in the orchard and small-fruit garden.]—136 pp., 23 pl., Oslo, H. Aschehoug & Co., 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 141, 1943.]

The coloured plates illustrating the pests and diseases of stone, pome, and small fruits in Norway are stated by the reviewer to be of unusual excellence, and in this connexion attention is drawn to the increasing use of colour in manuals of plant protection.

HILDEBRAND (E. M.). **Peach-suture spot.**—*Phytopathology*, xxxiii, 2, pp. 167–168, 1 fig., 1943.

A new disease of peaches, apparently affecting only the fruit, has been observed in an Elberta orchard on the shore of Lake Ontario in Wayne County, New York, and is believed to be identical with a disorder encountered in the Niagara Peninsula of Ontario in 1940. The conspicuous and distinctive lesions are situated exclusively in the suture region, hence the name of 'suture spot' is suggested to describe the condition, which is quite different from the red suture occurring in Michigan [*R.A.M.*, xx, p. 480]. The irregularly oblong-ovate, occasionally narrow elongate to nearly circular lesions usually develop across the suture, occupying three-quarters of its length and a maximum of one-eighth the circumference midway between the ends of the fruit. They originate beneath the skin as water-soaked, red-tinged areas, the centres of which soon turn brown, sink, and shrivel with the death of the affected tissues, while the red outer rim remains level with or slightly above the fruit surface. On sectioning, the texture of the diseased tissues is found to be somewhat corky and tough, with the vascular system in prominent relief. After about six weeks in storage only a few of the lesions on incompletely ripe fruits had expanded slightly. Suture spot is essentially a disease of harvest-time, at which period the affected trees, sometimes surrounded by entirely healthy ones, may easily be located by the fallen fruits on the ground. The cause is unknown, but failure of attempts to isolate bacteria or fungi from the lesions suggests that the disease may be due to a virus or a physiological factor.

BODINE (E. W.), NEWTON (J. H.), & KREUTZER (W. A.). **Four new virus diseases of stone fruits found in Peach mosaic study in Colorado.**—*Fm Bull. Colo. agric. Exp. Sta.*, iv, 2, pp. 6–10, 4 figs., 1942.

Golden net of peaches is the only one of the four virus diseases here described to which reference has not already been made, the others being rasp leaf of cherry [*R.A.M.*, xxi, p. 378], ring spot of apricot [ibid., xxi, p. 339], and the well-known X disease of peach, all except the last-named being reported exclusively from Colorado, where their existence has been revealed by the studies of peach mosaic in progress since 1934. Golden net was first observed on apricots and plums in 1937 and on the Elberta peach in 1939, the prominent marginal yellowing of the veins of the last-named host being responsible for the designation of the disease. During the

growing season irregular yellow areas also appear on the leaf blade, but the twigs and fruits do not suffer. Apricot trees are more severely affected, the leaves frequently showing interveinal crinkling and mottling, new stem growth being definitely stunted, and the market value of the fruits impaired by malformations and bumpiness. The only symptom of the disorder on Satsuma plums is a faint marginal mosaic of some of the leaf blades, often associated with irregular yellow blotches.

Christoff (A.). **Crown gall on fruit trees in Bulgaria.**—*Rev. Inst. Rech. agron. Bulg.*, *1940*, x, pp. 3–27, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 2, p. 156, 1943.]

The author reviews the literature on crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and discusses the effects of the disease on its hosts, the range of the latter (including those found in Bulgaria), the geographical distribution of the pathogen, its identification, biological and physiological characters, economic significance, methods of isolation and culture, control, and the existence of races resistant to the specific bacteriophage [*R.A.M.*, xviii, p. 158].

In connexion with the necessity for the provision of resistant stocks, the results of the writer's experiments in the inoculation of 113 lots of rootstocks, representing six species of *Prunus*, with *Bact. tumefaciens* are recorded. The extent of tumour formation in the various stocks was found to vary considerably. In a final test on a group of ten selected stocks, one (*P. insititia*) was ascertained to be completely resistant, while another (*P. spinosa*) contained only two infected trees out of six.

Williams (C. C.), Cameron (E. J.), & Williams (O. B.). **A facultatively anaerobic mold of unusual heat resistance.**—*Food Res.*, vi, 1, pp. 69–73, 2 graphs, 1941.

Two strains of a species of *Penicillium*, stated by C. Thom to be apparently undescribed, were isolated on wort and blueberry juice agar from blueberries in high-vacuum, enamel-lined cans and from the soil of five fields in which the crop was grown. One of the strains produced sclerotia exhibiting an exceptional degree of resistance to heat, being capable of withstanding upwards of 93·3° C.

Rangel (J. F.). **Toxicologia dos desinfestantes das sementes.** [The toxicology of seed disinfectants.]—*Bol. Esc. nac. Agron.*, *Rio de J.*, *1941*, 2, pp. 185–223, 1 fig., 1 graph, 1942. [English summary.]

With a view to the establishment of a standard method for the determination of the relative toxicity of seed disinfectants, the author investigated the experimental techniques of various foreign phytopathologists, as well as their different modes of estimating, expressing, analysing, and interpreting the resultant data. He tentatively accepts for this purpose the modification of Reddick and Wallace's 'slide-moist chamber method' proposed by the Committee on Standardization of Fungicidal Tests of the American Phytopathological Society (1940) and discusses various aspects of tests devised by several authors, accounts of which have already appeared in this *Review*.

In conclusion he emphasizes that besides its fungicidal and protective properties, other qualities of a seed disinfectant requiring consideration in connexion with its applicability for the end in view are its potential phytocidal effect, particle size, friction inducing capacity, hygroscopicity, and action on iron.

Trappmann (W.). **Pflanzenschutzmittel — gestern, heute und morgen.** [Plant-protectives—yesterday, to-day, and to-morrow.]—*Z. PflKrankh.*, liii, 1–3, pp. 93–106, 1943.

The following factors are discussed in relation to the development and elaboration of plant-protectives in Germany: (1) progress of biological research, (2) inten-

sification of agriculture, (3) world commerce and economy, (4) extension of the chemical industry and steady advance in the knowledge of chemistry, (5) the official German service for the testing of plant-protectives, (6) the world economic crisis, and (7) the need of planning for an expansion of the continental 'living space'.

After a historical introduction it is stated that during the last few years of peace, German agricultural products, including plant-protectives, found many new markets, especially in the Balkans and South America. At first the preparation and distribution of plant-protectives fell to the lot of the State research and experiment stations, but with increasing technical refinements and complications in the application of the treatments it became necessary to entrust the work of manufacture to the chemical industry, the achievements of which should be accorded full recognition. To-day it annually supplies the Reich with, *inter alia*, 20,000 tons of copper-containing or equivalent fungicides, 4,000 tons of sulphur sprays, and 10,000 tons of fruit tree carbolineum. Released from the actual preparation of the antiseptics, the research stations once more reverted to their normal functions of testing the chemical products submitted to them and transmitting to the industry their views on any necessary improvements. Future developments in the production of plant-protectives will thus be based on the co-operation of scientific and technical specialists. These observations are also applicable to the branch of engineering concerned with the manufacture of spraying and dusting machinery.

The official testing of industrial proprietary preparations, initiated by E. Riehm in 1913, amplified by the German Plant Protection Service in 1919, and extended on a legal footing in 1937 to include plant-protective equipment and storage disinfectants, is carried out at the Biological Institute, and among the objects thereby attained are (1) the exclusion from the market of worthless products, a public warning against which may be issued; (2) identification of reliable preparations by reference to their effective ingredients, e.g., derris and nicotine dusts; (3) general improvement in quality by comparison of all new products with the best on the market at the time, known as the 'standard', to which practice is attributed the high reputation enjoyed by German plant-protectives both at home and abroad; (4) standardization of the principal fungicides and insecticides, the standards set representing the Biological Institute's minimum demands for all products comprised in these groups; (5) elaboration of specially economical preparations to serve as 'universal disinfectants' for cereal seed-grain in connexion with the saving of raw materials; and (6) insurance of uniform composition by chemical supervision of the trade. In 1942 the numbers of officially recognized cereal seed-grain disinfectants, orchard, viticultural, horticultural, and agricultural plant-protectives, and storage pest-preventives were 9, 466, and 37, respectively, while the preparations submitted for preliminary testing numbered 213; these figures compare with four seed-grain disinfectants and 33 new products in 1922, when the other two groups were not represented at all.

With the advent of war the Biological Institute was called upon to help with the problem of a plant-protection policy. As a result, the manufacture of plant-protectives was concentrated in a small number of efficiently organized and fully utilized factories and limited to a few products recognized as contributing to the successful prosecution of the war, without making excessive demands on the raw material resources, all others, including copper- or sulphur-containing compounds, being rejected as superfluous for present-day needs.

Control of plant pests and diseases.—*Chem. & Ind.*, lxii, 21, p. 195, 1943.

The Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland are now prepared to receive applications from manufacturers or their

agents for consideration for official approval of plant-protectives of the following groups: (1) lead arsenate powders, (2) lead arsenate pastes, (3) lime-sulphur, (4) miscible tar oil winter washes, (5) stock emulsion tar oil winter washes, and (6) the organo-mercury dry seed dressings containing organo-mercury compounds as the sole active principle [*R.A.M.*, xxii, p. 71]. Requests for forms, indicating the number of applications to be submitted in each of the above groups, should be sent to the Secretary of the Advisory Committee, Plant Pathology Laboratory, Milton Road, Harpenden, Herts.

Mack (G. L.) & Reinking (O. A.). **The determination of particle size of fungicidal materials.**—Abs. in *Phytopathology*, xxxiii, 1, p. 8, 1943.

Particle size is the physical attribute of powdered fungicides [*R.A.M.*, xxii, pp. 146, 147, *et passim*] that chiefly determines the degree of their efficacy in disease control, and much confusion has arisen through the use of different terms for the designation of fineness and numerous methods of measurement. The lack of uniformity in size and shape of the particles present in all commercial wettable sulphur and insoluble copper fungicides causes a four- or fivefold variation between the largest and smallest of the several average diameters used to express particle dimensions. The shape factor in these disinfectants is of relatively slight importance, since the form of the individual particles in most cases approximates to that of a sphere.

The particle size of 11 representative copper and sulphur fungicides was ascertained by four entirely independent methods and expressed as three different average diameters. The Andreasen sedimentation and the air permeation techniques yielded concordant data. The diameter of the particle of average specific surface appeared to be that most nearly related to the comparative toxicity of the materials tested. Specific surface being a property independent of the degree of uniformity of the sample and closely correlated with fungicidal toxicity, this term is proposed to express the fineness of plant-protective dusts.

Hamilton (J. M.). **Comments from the study of fungicides in 1941.**—*Proc. N.Y. St. agric. Soc., 1942*, pp. 41–42, [1942].

Flotation sulphur paste, purchased for use during the coming season, should be obtained freshly made, whereas with the dry-wettable forms, the older they are, the better. Both in 1940 and 1941, bentonite hastened the setting of the dry wettables. Its use was, however, detrimental if rain fell within 15 minutes of spraying under poor drying conditions. Lime (1 in 100) gave ideal results after 15 minutes, and its use with wettable sulphurs to increase adhesiveness is thoroughly desirable when they are applied in unsatisfactory drying conditions.

Orthex [*R.A.M.*, xxi, p. 244] inhibited the fungicidal action of sulphur when the spray mixture was cold (50° F), or when the water was obtained from a running stream early in the season. With water at about 70°, orthex does not act in this way and gives a film on the foliage resembling that seen when the leaves are wet. Lime (1 in 100) eliminates or considerably reduces the smothering effect of the orthex with cold water.

The evidence demonstrated that the use of a sticker is less important than adjustment of the spray mixture to give a uniform film of spray on the leaves. Mineral oil stickers tend to inhibit fungicidal action, though vegetable oils do not. Some other stickers also materially reduce fungicidal effectiveness.

Orthex may be employed in showery weather before the cover sprays. SS-3 and sprasoy A with lime $\frac{1}{2}$ in 100 are good spreaders, the latter particularly with lime-sulphur, and the former with Bordeaux mixture.

McNew (G. L.). **Relative effectiveness of organic and inorganic fungicides as seed protectants.**—Abs. in *Phytopathology*, xxxiii, 1, p. 9, 1943.

At least three organic fungicides have shown promise as substitutes for the copper and mercury compounds now in use as vegetable seed protectants, namely, tetrachloro-para-benzoquinone (spergon) [*R.A.M.*, xxii, p. 160], ferric dimethyl-dithiocarbamate (fermate) [ibid., xxii, p. 213], and tetramethyl thiuramdisulphide (thiosan) [ibid., xxii, p. 115], which have effectively prevented infection by *Pythium ultimum* in greenhouse tests and also given excellent results in the field [in Wisconsin]. These preparations are the only ones suitable for application to Lima beans [*Phaseolus lunatus*], and they appear to be superior to the metallic treatments on peas. Sufficient data have been obtained to recommend spergon for peas and Lima beans but further tests of fermate and thiosan are required for these two crops and for spinach and sweet corn [maize]. In replicated experiments with nine treatments on sweet corn in 1942, thiosan produced the heaviest increase in yield (20 per cent.) followed by semesan jr., barbak C [ibid., xix, p. 636], and spergon. The augmented yields of peas were due to the prevention of seedling loss from pre-emergence seed decay and of weakening of the plants through post-emergence infection.

Palmiter (D. H.) & Hamilton (J. M.). **A new fungicide.**—*Proc. N. Y. St. Agric. Soc. 1942*, pp. 207–209, [1942].

Experiments in the Hudson Valley made to find an organic fungicide superior to sulphur in fruit disease control demonstrated that ferric dimethyldithiocarbamate [fermate: see preceding abstract] is at least twice as toxic as sulphur to the spores of some fungi and sticks better than most other organics, while it costs about the same as sulphur fungicides. At 2 in 100, it controlled apple scab [*Venturia inaequalis*] on McIntosh trees as effectively as the best dry wettables at 5 in 100 or flotation paste at 8 in 100. Used only in the cover sprays at 1 in 100, it was as effective as flotation paste at 6 in 100, and reduced infection to under 1 per cent. When five applications at ½ in 100 (pink, bloom, calyx, and first and second cover) were made on Rome trees in comparison with similar applications of micronized sulphur 5 in 100, it gave perfect control of cedar rust [*Gymnosporangium juniperi-virginianae*], though the sulphur reduced leaf infection by only 50 per cent. When the bloom spray was omitted, fermate ½ in 100 and 1½ in 100 gave 81 and 94 per cent. control, respectively, though sulphur 5 in 100 gave only 16 per cent.

Used against sweet cherry brown rot [*Sclerotinia fructicola* and *S. laxa*] just before picking, fermate ½ in 100 plus ½ pint cottonseed oil spreader left no visible residue and protected the fruit from decay for several days under conditions favourable for rot development. Applied two weeks before harvest at 1 in 100 plus cottonseed oil it gave the fruit complete protection, though 4 in. of rain fell during this period; the fruit had no objectionable residue when picked. Under the same conditions, micronized sulphur 2 in 100 plus cottonseed oil allowed 50 to 60 per cent. of the fruit to become infected before harvest. An additional advantage of the use of cottonseed oil is that it reduced cracking caused by rains.

Baker (R. E. D.). **Notes on some diseases of field crops, vegetables and fruits at the Imperial College of Tropical Agriculture.**—*Trop. Agriculture, Trin.*, xx, 2, pp. 28–32; 3, pp. 59–63, 1943.

These notes, based on observations recorded from 1939 to 1942 at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, deal with bacterial, fungal, virus, and nematode diseases of cereals, sugar-cane, fodder grasses, root crops, legumes, fruits, vegetables, and miscellaneous crops including cotton and tobacco [cf. *R.A.M.*, xxi, p. 281].

RIEHM (E.). **Über die Zunahme der Pflanzenkrankheiten und Schädlinge.** [On the increase of plant diseases and pests.]—*Z. PflKrankh.*, liii, 1–3, pp. 1–12, 1943.

This is a discussion, illustrated by concrete examples and references to the relevant literaure, of the complex problem of the increase in the number and intensity of plant diseases in Germany. Entirely divergent conclusions as to the rising or falling incidence of plant pathogens have been reached by different workers, Blunck, for instance, expressly affirming (*Z. PflKrankh.*, xxxix, p. 1, 1929: *Oldenburg. LandwBl.*, p. 1946, 1930) that epidemics are on the upward grade both in numbers and severity, while Morstatt [*R.A.M.*, xiii, p. 588] is of the opinion that German agriculture is threatened only by the introduction of foreign parasites, though an intensification of the economic importance of already existing diseases is conceded. In the present writer's view, neither opinion can be categorically confirmed since appreciation depends on the duration of the periods compared and on the different conditions governing the occurrence of individual vegetable and animal parasites.

It must be admitted that the last fifty years have seen a decline in the losses due to many plant pathogens, and it is, indeed, barely conceivable that all the efforts made to minimize the damage should have borne no fruit, unless either the virulence of the parasites or the susceptibility of their hosts should have increased to such an extent that counter-measures merely served to restore the equilibrium and reduce the resultant losses to a tolerable level. In actual fact, however, a number of diseases have been entirely deprived of their economic significance by plant-protective methods. Ergotism, for instance, due to the consumption of flour made from rye infected by ergot [*Claviceps purpurea*], was common in various parts of the country some 90 years ago and occurred in a severe form in East Prussia in 1867–8 (E. Meyer; Beitrag zur Entwicklungsgeschichte der Phytopathologie und des Pflanzenschutzes, Inaug. Diss., Berlin, 1928), but has now become a rarity except in the absence of up-to-date cleansing facilities (*Öffentl. GesundhDienst*, viii, p. 213, 1942). Wheat bunt [*Tilletia caries* and *T. foetida*] is in general much less prevalent than it was 50 years ago, and among fruit diseases of steadily diminishing importance may be mentioned American gooseberry mildew [*Sphaerotheca mors-uvae*], once the cause of 'heavy depredations' (*Ber. Landw. Berl.*, 30, p. 123, 1910) and apple scab (*Fusicladium*) [*Venturia inaequalis*]. On the other hand, virus diseases, notably of potatoes, are obviously spreading from the west to the east of Germany, coinciding with an expansion in the same direction of peach cultivation [see below, p. 268].

Blunck has pointed to an increase of wheat foot rots [*Ophiobolus graminis*, *O. herpotrichus*, *Cercosporella herpotrichoides*, and *Fusarium* spp.: *R.A.M.*, xiii, p. 153], and inappropriate manuring schemes (such as those resulting in the insolubilization of boron and consequent development of heart and dry rot of beets [ibid., xviii, p. 428]), have largely contributed to the occurrence and extension of many diseases.

The actual number of plant diseases and pests has risen during the last century. This increase is not only an apparent one, due to the closer study of phytopathology, but cultivated plants have definitely been colonized by new parasites formerly found only on weeds, e.g., *Synchytrium endobioticum*, unknown in the country of origin of the potato, was presumably an unrecognized inhabitant of wild Solanaceae in Great Britain, where it spread to the cultivated crop in the seventies of the last century; in North America, *Pseudoperonospora cubensis*, originating on wild Cucurbitaceae in South America, migrated to the cucumber and vegetable marrow, while *P. humuli* passed from wild to cultivated hops. Increased commerce in plants has led to the introduction of pathogens into countries formerly free from them.

Another vital question remains: has the virulence of the parasites or the suscepti-

bility of the hosts increased? Although some well-known examples of variations in the aggressiveness of the different physiologic races of certain fungi could be cited in support of the former hypothesis, convincing evidence is not forthcoming. At the same time, the work of plant-breeding during the past two decades has been directed, in many cases with conspicuous success, towards a combination of disease resistance with heavy cropping. There is thus no question of any general increase in the susceptibility of plants to disease, but the viruses constitute a very serious exception to this rule, the absolute figure for diseases of this type having risen substantially. Speculation is rife as to the nature and etiology of the viruses, but the one positive fact is their multiplication in such an alarming fashion that their control constitutes the foremost phytopathological, or one may even say biological, problem of the day.

KLINKOWSKI (M.). **Pflanzenpathologie im Ostland. I. Mitteilung. Aufgaben der Pflanzenpathologie und des praktischen Pflanzenschutzes im baltischen Ostland.** [Phytopathology in the Ostland. Note I. Tasks of phytopathology and practical plant protection in the Baltic Ostland.]—*Z. PflKrankh.*, liii, 1–3, pp. 12–18, 1943.

The 'Ostland, an entirely new political conception', comprises the Baltic Provinces of Estonia, Latvia, and Lithuania, and White Ruthenia, of which the first three constitute an agricultural unit, while the last-named calls for the application of different standards and is reserved for future discussion. The phytopathological administration of the Baltic provinces has now become a function of the Reich Commissariat, and the writer was appointed in 1941 to study the position and requirements of the different regions concerned. Briefly to sum up the information thus acquired, it may be stated that in Lithuania both research and practical plant disease control are still in a rudimentary state, commanding next to no interest in agricultural circles, while in Latvia very considerable progress has been made during the last two decades, more especially in the practical problems of disease control. In Estonia, however, the practical application of the noteworthy results attained in scientific studies at the University of Dorpat has proved less feasible than in Latvia.

One of the foremost tasks to be undertaken by the newly constituted authorities is the development of a plant protection warning service under uniform organization. Such services already exist in Latvia and Estonia, but not in Lithuania. The preliminary steps towards the realization of this project have already been taken. Another urgent necessity is the installation of facilities for seed-cleansing and treatment, more especially the former, which are practically unknown, for instance, over wide tracts of eastern Latvia. The importance of seed-grain disinfection is recognized in Latvia, and to a lesser extent in Estonia, whereas Lithuania, the largest of the Baltic Provinces, is the most backward in this respect, copper sulphate or formalin being mainly used where treatment is carried out at all and the annual consumption of up-to-date preparations amounting to less than a ton; only 14 seed-disinfection machines were found in the whole country, so that no idea of introducing large-scale dusting can be entertained for the time being.

The survival of the rye crop through the winter in many parts of the Provinces depends less on 'winter injury' than on the development of the snow mould [*Calonectria graminicola*]. Loose smuts of wheat and oats [*Ustilago tritici* and *U. avenae*] may also be responsible for heavy losses, amounting in eastern Latvia in 1941 to 20 per cent., while both diseases were prevalent in 1942. A mobile co-operative seed-treating installation is shortly to be set up in this district.

Flax is extensively cultivated in the 'Ostland' and the treatment of the seed, in the first place against the destructive *Colletotrichum lini* and secondly against *Fusarium lini*, is another important development of the future. The Provinces are

conceived as large-scale providers of fodder-clover and grass seeds for the German 'living-space', and in this connexion attention is drawn to the need for combating *Sclerotinia trifoliorum* and *Gloeosporium caulivorum* [*Kabatiella caulivora*] among other seed-borne disease.

The 'Ostland' is further expected to serve as a source of seed potatoes for the 'living-space' of the U.S.S.R. and other parts of Europe. Latvia and Estonia had already found markets for their produce before the war, both in Europe and overseas, the absence of wart disease [*Synchytrium endobioticum*] from these countries being one of the factors enabling them to compete successfully against Germany, Holland, and Poland. The pathogen does occur, however, both in Lithuania proper and in the former Polish territory ceded to Lithuania, two local foci of infection having been detected. Of much greater importance than wart disease from the angle of seed potato production are the viruses, which have hitherto been reported to be of no account in the Baltic Provinces. This was also the writer's impression from an inspection, during the Russian campaign of 1941, of the potato fields of Lithuania, eastern Latvia, and the territory of the U.S.S.R. as far as Lake Ilmen, but he has formed another opinion since taking up residence in the 'Ostland' and visiting different regions. The lack of experts on virus diseases is a great obstacle to the development of seed potato production in the Provinces along the projected lines, but it is hoped that this may shortly be overcome. Late blight (*Phytophthora infestans*) exacts a heavy toll of the potato crops, especially in Estonia and Latvia, where spraying with Bordeaux mixture has hitherto been virtually confined to the experiment stations. For the present the shortage of copper and machinery does not permit of any great advance in the control of this disease, but it is one of the matters requiring attention later. Other potato pathogens of relatively frequent occurrence are *Bacillus phytophthorus* [*Erwinia phytophthora*], *Alternaria solani*, and *Cercospora concors*.

Sugar beets are grown only in Latvia and Lithuania. In the former, where the area under the crop comprises 20,000 ha., plant disease control measures were applied annually over an average acreage of 1,500 to 2,500 ha., of which 1,000 to 2,000 were destroyed by heart and dry rot; preparations for combating this disorder are on sale at the sugar factories. *Cercospora beticola* is assuming increasing severity, causing such heavy damage in some seasons as to threaten the further cultivation of the crop.

Kirulis (A.). **Die mikroskopischen Pilze als natürliche Feinde der Pflanzenkrankheiten in Lettland.** [The microscopic fungi as natural enemies of plant diseases in Latvia.]—*Arb. landw. Akad. Mitau*, i, pp. 479–536, 1942. [Abs. in *Z. PflKrankh.*, lii, 12, p. 549, 1942.]

The writer's studies in the very imperfectly explored field of hyperparasitism among fungi revealed the existence of true parasites chiefly in the genera *Cicinnobolus*, *Darluca*, and *Tuberculina*, of facultative parasites in *Cladosporium* and *Fusarium*, and of symbionts, commensals, and the like in *Ramularia*. Up to the present 23 members of the Erysiphaceae have been recorded as hosts of *Cicinnobolus cesatii* [*R.A.M.*, xviii, p. 803]. *Darluca filum* attacks not only 71 rusts [ibid., xxi, pp. 472, 493] but a large number of other species. *Pseudogloeosporium rubi* lives at the expense of *Phragmidium*, *Barbarosporina rhytismatis* n. sp. at that of *Rhytisma salicinum*, *Gloeosporium roseolum* in the fruit bodies of *Melasmia acerina* and on *R. symmetricum*, *Ramularia coleosporii* is a non-parasitic symbiont of four rusts, while three facultative parasites, viz., *Cladosporium aecidiicola*, *C. exobasidii*, and *C. exoasci* inhabit, respectively, Pucciniaceae and Melampsoraceae, Exobasidieae, and *Taphrina pruni*. *Rhytisma salicinum* and *R. symmetricum* also serve as hosts of *Columnophora rhytismatis* (Bres.) Bub. & Vleug. *Tuberculina persicina* [ibid., xix, p. 730] parasitizes numerous rusts, *Hymenula spermogoniopsis*

is a commensal of *Triphragmium*, *Puccinia*, and *Melampsora*, while three facultatively parasitic species of *Fusarium*, i.e., *F. avenaceum*, *F. heterosporum*, and *F. poae*, are found, respectively, on rusts and *Claviceps purpurea*, rusts and smuts, and smuts.

FUCHS (W. H.). **Hochschulausbildung in Phytopathologie und Pflanzenschutz.** [College education in phytopathology and plant protection.]—*Z. PflKrankh.*, liii., 1–3, pp. 107–113, 1943.

Assuming that phytopathology and plant protection will enter largely into the solution of the problems connected with agricultural self-sufficiency in the post-war European economy, the writer outlines his plans for the training of students in these subjects [*R.A.M.*, xxi, p. 465]. Phytopathology and plant protection are distinguished from each other and compared with the scientific and clinical aspects of medicine, respectively, the former being concerned in a general way with the symptomatology, anatomy, and physiology of infected plants and the etiology of disease, the epidemiology of parasites and theoretical plant-protective therapy, and the latter with the practical applications of these studies to the disorders of particular economic crops and their control by cultural methods and disinfectant treatments. Some proposals for the readjustment of the college curriculum to meet these requirements are made.

WOODS (M. W.). **Respiration and virus diseases.**—*Chron. bot.*, vii, 6, pp. 243–244, 1942.

After briefly summarizing the literature on respirational problems connected with virus diseases of plants, the author attributes the conflicting results frequently obtained by various workers to differences in methods and techniques used, and suggests that the application of half-leaf comparison technique and micro methods will eliminate many of the variable factors which make the interpretation of results difficult at present.

THOMAS (W. D.). **Mycorrhizae associated with some Colorado flora.**—*Phytopathology*, xxxiii, 2, pp. 144–149, 1 fig., 1943.

A tabulated account is given of the writer's studies on the mycorrhiza of Colorado flora in 1939 and 1940 [*R.A.M.*, xxi, p. 313]. The ectotrophic form developed only on trees and shrubs, the coralloid type predominating; it was found on pines (*Pinus contorta*, *P. flexilis*, and *P. ponderosa*), spruce (*Picea pungens*), *Pseudotsuga taxifolia*, *Abies concolor*, junipers (*Juniperus scopulorum*, *J. virginiana*, and *J. communis*), poplars (*Populus deltoides* and *P. tremuloides*), oak (*Quercus utahensis*), elm (*Ulmus americana*), *Celtis occidentalis*, *Prunus americana*, *P. pennsylvanica*, and *P. virginiana*, while the ball type was confined to *Salix scouleriana*, birch (*Betula fontinalis*), and alder (*Alnus tenuifolia*).

Ectendotrophic mycorrhiza were observed only on six species, viz., *Picea engelmanni*, *Prunus virginiana*, ash (*Fraxinus pennsylvanica*), *Robinia pseudacacia*, *Gleditsia triacanthos*, and *Cercocarpus montanus*.

Of the three types of endotrophic mycorrhiza, namely, peloton, arbuscule, and vesicle, the first-named was the most common, among its 21 hosts being *Gentiana elegans*, *Pentstemon secundiflorus*, and *Delphinium subalpinum*; vesicles were harboured by 17, including lucerne, *Ribes saximontanum*, and two species of *Vaccinium*, and arbuscules by seven, among them *Rudbeckia hirta*. No true endotrophic mycorrhiza were detected in tree or shrub roots.

The hosts of pseudomycorrhiza were *Pinus contorta*, *P. flexilis*, *P. ponderosa*, *Picea pungens*, *P. engelmanni*, *Pseudotsuga taxifolia*, *Juniperus scopulorum*, *J. virginiana*, *Gleditsia triacanthos*, elm, *Prunus americana*, and *P. pennsylvanica*.

BJÖRKMAN (E.). **Mykorrhizans utbildning och frekvens hos skogsträd på askgödslade och ogödslade delar av dikad myr.** [The development and incidence of mycorrhiza among forest trees on ash-fertilized and unfertilized sectors of drained marshes.]—*Medd. Skogsförsöksanst., Stockh.*, 32, pp. 255–296, 19 figs., 1941. [German summary.]

Following a survey of the ecological relationships of the marshes of Västerbotten, Sweden, drained in 1910, the author fully describes and tabulates the various types of mycorrhiza encountered in 1939 and 1940 among the stands of spruce, pine, and birch, which were very sparse, with correspondingly poor mycorrhizal development, except where wood ash had been applied in 1918 and 1926 at the approximate rates of 3,300 and 12,500 kg. per ha., respectively. Types A, B, C, and D, the last-named comprising Da and Dn (*Mycelium r*[*adicis*] *atrovirens* and *M. r. nigrostrigosum*, respectively) [*R.A.M.*, xix, p. 423], were all represented on the conifers: the birch roots were covered with a dense coil of elongated short-root branches of the monopodial type, provided with a whitish-grey hyphal mantle and strands, presumably identical with the formation designated by Melin in Malmström's preliminary report on a limited amount of material from the same locality (*Medd. Skogsförsöksanst., Stockh.*, 28, 1935) as an aberrant form of A.

The following higher fungi were observed in the birch woods of the fertilized sectors in the southern portion of the marshes in association with *Polytrichum*: *Boletus scaber*, *Collybia confluens*, *C. dryophila*, *Entoloma rhodopolium*, *Lactarius trivialis*, and *Paxillus involutus*. In the untreated sectors the fruit bodies of this group of fungi were much scantier except among pines in the *Andromeda polifolia* association on the borders of the marshes, where *B.* spp., in particular are often to be found. Where *Molinia coerulea* flourishes *B. scaber*, *L. rufus*, and *P. involutus* are fairly common. In the northern area of the moorlands (*Deschampsia caespitosa* and *Calamagrostis purpurea* association), the following organisms were present on the fertilized sectors, though in very small numbers as compared with the incidence in the southern region. *B. scaber*, *Clitocybe candicans*, *C. agathiformis*, *Collybia confluens*, *C. dryophila*, *Cortinarius* sp., *Hebeloma* sp., *Hygrophorus miniatus*, *Inocybe lacera*, *Laccaria laccata*, *Lactarius glyciosmus*, *L. torminosus*, *Lepiota amianthina*, *Lycoperdon piriforme*, *Omphalia umbellifera*, *Peziza badia*, *Thelephora terrestris*, and *Tricholoma grammopodium*.

WAKSMAN (S. A.) & HORNING (E[LIZABETH] S.). **Distribution of antagonistic fungi in nature and their antibiotic action.**—*Mycologia*, xxxv, 1, pp. 47–65, 1 fig., 2 graphs, 1943.

In a study of antagonistic fungi in soil and other natural substrata the following methods of isolation were developed: (1) agar plates seeded with various bacteria were inoculated after 12 to 24 hours with small particles of soil or manure, and (2) washed suspensions of different living bacteria were added to washed agar containing a carbohydrate and some phosphate, and this bacterial agar used for plating out the soil or the manure. The following slight modification of the second method was most frequently used: two- to three-day-old cultures of *Bacillus subtilis*, *Sarcina lutea*, *Staphylococcus aureus*, and *Escherichia coli* grown on agar or on liquid media were suspended in sterile water, centrifuged, washed, again centrifuged, and then added to washed agar containing 1 to 3 per cent. glucose and 0·05 to 0·1 per cent. potassium dihydrogen phosphate, the slightly acid reaction of the medium making it highly favourable for the development of antagonistic fungi. The soil or manure was plated out on this agar in dilutions of 1 : 500, 1 : 2,000, and 1 : 10,000, and the plates incubated for two to four days at 25° to 28° C. Bits of mycelium were later transferred to plates of sterile glucose and glucose-peptone agar and replated, when necessary, to obtain pure cultures. Only such cultures were selected for study as showed a clear zone between the colony of the fungus

and that of the test bacteria. The most satisfactory method of determining the antibiotic activity of antagonistic fungi, tested in liquid media, was to incorporate varying amounts of the fungal filtrates into nutrient agar and to streak the plates with two to four test bacteria. Positive or negative growth of these test organisms gave the limit of activity or the concentration of the active substance in the filtrate. The time of incubation varied with different test organisms from two to five or more days; in most cases the activity remained unimpaired by continued incubation, but sometimes it was reduced or completely stopped after an additional day or two. This is taken to indicate that in some fungi either the active substance is destroyed by prolonged incubation or that the test organism becomes adapted to the substance, while certain other fungi seem to produce substances that remain active for only a short time.

The antagonistic fungi isolated in the present study fall into nine distinct taxonomic groups: (1) the *Chaetomium* group, comprising one strain; (2) the *Aspergillus fumigatus* group, 15 strains; (3) the *A. clavatus* and *A. glaucus* groups, two strains of the former, and one of the latter (4) the *A. flavus* group, one strain; (5) the *Penicillium luteum-purpurogenum* group, 20 strains; (6) the green *Penicillium* group, 21 strains and the highly active *P. notatum*; (7) the *Trichoderma* group, two strains; (8) the *Fusarium* and *Cephalosporium* group, 15 strains; and (9) a miscellaneous group, comprising strains either incompletely identified or insufficiently studied. The various fungi were found to differ markedly in activity; some produced antibiotic substances which could readily be isolated from the medium, while with others, extraction or adsorption methods gave unsatisfactory results. Some of the fungi (e.g., *P. notatum*) were found to comprise strains, even among those isolated from the same mother culture, varying considerably in their antibiotic activity. It appeared that nutrition has an important influence on the production of antibiotic substances of *P. notatum*: the presence of iron increased the general activity of the culture as well as the special one against *E. coli*, while zinc, even in a concentration of 10 mg. zinc sulphate per l. greatly reduced the general activity and completely repressed the activity against *E. coli*, and manganese had little effect. Another factor was volume of medium: some fungi were more active when grown in deep and others when in shallow layers. Temperature at incubation was in most cases optimal at 28° or lower, but many fungi grew well at 37° and even 50°. Some fungi produced the antibiotic substance after two to five days of incubation, while others required a longer period. In the case of *P. notatum*, the substance active against *E. coli* appeared after two to four days and disappeared rapidly, while substances active against other bacteria began to appear later. An antibiotic substance, tentatively designated fumigacin [*R.A.M.*, xxii, p. 91], was isolated from fungi of the *A. fumigatus* group. The substance is soluble in chloroform and alcohol and partly soluble in ether and water; it is thermolabile in the culture filtrate, but becomes more thermostable after concentration. The substance was more active against *B. mycoides* than against *B. subtilis*, this being the reverse of the effect of other antibiotic substances tested against these two organisms.

Brodski (A. L.). **Antagonism between soil infusoria and [plant] pathogenic fungi.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxiii, pp. 81–83, 1941. [Abs. in *Brit. chem. Abstr.*, A, III, *1943*, p. 275, 1943.]

In artificial media the mycelium of *Verticillium dahliae* makes no growth in the presence of *Culpoda*, and its pseudosclerotia fail to germinate, a similar but much weaker action on the fungus being exerted by *Bacillus mesentericus* and *Bacterium* [*Pseudomonas*] *fluorescens*. Tomato plants grown in aqueous media to which pseudospores of *V. dahliae* are added develop wilt symptoms after bud formation, whereas no sign of infection appears on the flowers or fruit of plants in comparable cultures containing the infusoria in an active form. In wilt-infested soil the

incorporation of *Culpoda* materially lowers the incidence of diseased plants and substantially increases yields.

KLAPP (E.). **Arbeiten zur praktischen Bekämpfung des Kartoffelabbaus.** [Investigation on the practical control of Potato degeneration.]—*Forschungsdienst, Sonderh.* 16, pp. 370–377, 1942. [Abs. in *Z. PflKrankh.*, lii, 12, pp. 544–545, 1942].

This is a report on the investigations carried out from 1938 to 1941 by the members of various agricultural and plant-breeding associations, in co-operation with the Bonn Institute of Soil Science and Agriculture, on the practical possibilities of combating potato degeneration. In the Bonn experiments, the relative yields of several ordinary commercial varieties, reckoning 100 per cent. for the original selected stock, were 38·4, 22·8, 19·5, and 15·2 per cent. for the first, second, third, and fourth successive crops, respectively, the reductions for the officially approved varieties (first and second successions) being to 72·9 and 46·7 per cent., respectively, while the corresponding disease percentages rose from 13·9 per cent. in the original selected stock to 50·3 and 74·7 per cent. in the first and second following crops, respectively. Thus, even the best seed stocks in the 'degeneration areas' of western Germany are likely to comprise only 25 per cent. healthy plants after the second successive cropping and to produce less than half the quantity secured from the original selected material. Among the comparatively resistant or tolerant varieties are Ostbote, Mittelfrühe, Roland I, Flava, and Ackersegen.

In tests to determine the radius of infection, a decrease of 24 per cent. occurred between the focus of disease and the tenth row, beyond which the decline was only slight. The yield of the succeeding crop increased by 45 per cent. over the same radius. In the direction of the prevailing wind the portion of the stand behind the centre of infection is in greater danger of attack than that in front of it. The beneficial effects of the selection of healthy plants for the provision of 'seed' was confirmed. Early harvesting resulted in an up to 49 per cent. heavier yield and 92 per cent. less disease, but tubers lifted before maturity do not keep well and are physiologically inferior. An effect comparable to that produced by early lifting was secured by cauterizing the stands with powdered kainit or raphanit, the use of a poisonous spray, such as cresol-fruit tree carbolineum, or removal of the foliage by cutting. Normal planting distances gave the best results. The application of nicotine sprays led to large increases of yield during the current season through the reduction of aphid injury, but even weekly treatments failed to protect succeeding crops.

Köhler's method of testing cuttings as an index to the value of the seed stocks from the point of view of degeneration has been adopted at a number of plant-breeding stations, and is thought to be the best procedure yet devised for this purpose. *Myzus persicae* remains the sole vector of any importance in the transmission of potato degeneration diseases, hence the distribution of the latter coincides, generally speaking, with that of intensive peach cultivation [*R.A.M.*, xx, p. 487].

KLAPP (E.). **Einflüsse der Düngung mit und ohne Virusschutz auf den Pflanzwert der Kartoffel.** [The effects of manuring with and without virus protection on the value of Potatoes for seed.]—*Z. PflKrankh.*, liii, 1–3, pp. 25–36, 1 fig., 1943.

At the Bonn-Poppelsdorf Experiment Station, in order to determine the effects (both direct and in relation to virus diseases) of different manuring schemes on the value of potatoes for seed, medium-early plants of healthy stock were grown in boxes of 90 to 100 kg. capacity sunk into the soil (three per box, five replications), the Eigenheimer variety being used in 1939 and a first-class selection of Flava and

Böhm's Mittelfrühe in 1940 and 1941, respectively, under the following conditions. One section (A) was left to grow without protection, a second (B) covered with muslin stretched over a wooden framework and sprayed with nicotine to exclude aphids, and a third (C) similarly shielded but exposed at frequent intervals to infestation by *Myzodes* [*Myzus*] *persicae* [see preceding abstract]. Nitrogen, potassium, and phosphorus were applied in seven combinations, the two former at the rate of 10, and the last-named at that of 5 gm. per box.

Taking the three-year series of experiments as a whole the weighted average increase of second-year yields due to protection against viruses was 32·9 per cent., while artificial infestation by *M. persicae* caused reductions of 31·8 and 9·5 per cent., respectively, as compared with the protected and random-infection plots. Nitrogen deficiency was responsible for the maximum injury to the crops, both with and without virus infection. In section (A) the omission of potash from the fertilizer resulted in the heaviest yields, whereas in (B) and (C) a complete fertilizer in various combinations gave higher yields than the omission of any one element. As regards virus protection, there was no essential difference between ammonia and saltpetre, though the latter appeared to be slightly superior on a two-year average in section (A). Urea, which exerted a not unfavourable effect in (A), was distinctly less advantageous in (B). Potassium sulphate magnesia was more beneficial in (A) than the 40 per cent. salt, but less so in (B) and (C).

The most conspicuous diseases in the second-year crops were various types of mosaic, streak necroses, and virulent mixed infections.

Younkin (S. G.). **Purple-top-wilt of Potatoes caused by the Aster yellows virus.**—Abs. in *Phytopathology*, xxxiii, 1, p. 16, 1943.

Evidence is submitted for the possible implication of the eastern strain of the aster yellows virus [*R.A.M.*, xxii, p. 206] in the causation of purple-top wilt of potatoes [ibid,. xvii, p. 700; xxii, p. 221]. *Macrosteles divisus* was shown by extensive tests to convey a strain of the aster yellows virus from naturally infected *Ambrosia artemisiifolia* to potato, inducing purple-top symptoms typical of those observed in the field. From preliminary trials it appears that insect number may be a limiting factor in the effective transmission of the virus to potatoes. Thus, in the case of insect populations with a minimum of 95 per cent. infective individuals, ten insects per plant resulted in a significantly higher incidence of infection than five, whereas 20 were of no more use than ten. In greenhouse tests, Green Mountain was less susceptible to the wilt than Katahdin and Smooth Rural. In four out of 200 grafts on *Nicotiana rustica* with scions from spontaneously infected Katahdin, Sebago, Rural, and Cobbler potato plants from 18 localities in New York and Pennsylvania, transmission of the virus was effected, the symptoms of all four strains on *N. rustica* being identical, but distinct from those induced by the *Ambrosia* strain. On asters [*Callistephus chinensis*] all strains of the virus seemed to produce similar effects.

Walters (S. W.). **Production of seed Potatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 139–142, 148, 2 figs., 1943.

Brief notes in popular terms, designed to assist South African seed potato-growers, are given on selection, sprouting, methods of cultivation, and the prevention of virus diseases.

Bald (J. G.) & White (N. H.). **Potato virus X: the average severity of strain mixtures in three varieties of Potato.**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 300–306, 1 graph, 1942.

The average severity of mixtures of strains of potato virus X [*R.A.M.*, xx, p. 220] in potato varieties was studied in Early Carman, Late Carman, Western

Australian, Delaware, and Tasmanian Brownell, the severity of the strains carried being assessed by the symptoms produced in *Datura stramonium*.

The tubers to be tested were numbered and set out on a tray, and 6-in. pots, each containing two or three *D. stramonium* seedlings at the two-leaf stage, were placed on the bench. A piece of sandpaper $1\frac{1}{2}$ in. sq. was placed on a piece of plain paper about 6 in. sq., and the pot label was used to hold the paper and sandpaper firm. The skin on a corner of a tuber was broken and the dirt removed by drawing the tuber across the paper, after which the exposed surface was lacerated by rubbing on the sandpaper. One to several drops of dilute phosphate buffer solution (about M/200 at P_H 7) were allowed to fall on the exposed surface, and the tuber was then drawn across the leaves of the *D. stramonium* seedlings in one pot, which had previously been dusted with carborundum powder. The leaves were then sprayed with water. One hundred per cent. infection usually resulted. When the symptoms had developed fully, they were rated according to mottle and degree of necrosis, and plants without symptoms were inoculated with a necrotic strain of virus X to ascertain if they carried a masked strain or were free from infection.

In the first experiment, the mean ratings for Early and Late Carman were 2·68 and 2·64, respectively. From this it is concluded that the two types carried almost identical virus mixtures.

In experiments with the three varieties the mean ratings for Delaware were 2·11 and 2·32 (from selected and certified stock, respectively), for Carman 2·57 and 2·68 (Early and Late, respectively), and for Brownell 3·19, which showed that these three varieties carry virus mixtures which differ considerably in severity. The ratings for Early and Late Carman are not significantly different, but those for the two lots of Delaware are. As has already been found with Up-to-Date (in work not yet published), single plant selections of Delaware made on a basis of vigour and relative freedom from mottle were found to reduce the proportion of plants carrying the severer strain mixtures of virus X, the frequency of ratings of 0·1 to 1·0, 1·1 to 2·0, 2·1 to 3·0, and 3·1 to 4·0 in selected and certified stock being 11, 15, 16, and 0, respectively, and other experiments gave similar results.

In explanation of these findings the authors put forward the hypothesis that a natural equilibrium exists between strains of the virus for each variety. It is pointed out that mixtures containing predominantly mild strains with a small admixture of the ring spot and necrotic strains do not remain constant when repeatedly subcultured on susceptible hosts. The more severe strains often multiply at the expense of the milder ones, and the average severity of the mixture increases. In extreme cases, a limit to the multiplication of a severe strain is imposed by the damage it does to the host tissues. For instance, in potato varieties, on which the necrotic strain of virus X causes a fully necrotic reaction, it can barely, if at all, persist in the pure state, as it kills the sites for its own multiplication. It can persist in mixtures with milder strains producing mottle or a partial necrosis. By extension of this principle, the limit set to virus multiplication is inversely related to injury effected to the host tissues. Mild strains may never reach this limit. A mixture of mild and severe strains in a susceptible host will usually approach an equilibrium represented by the balance of two opposing tendencies. Such a hypothesis provides a likely explanation for the occurrence of similar populations of virus mixtures in long separated families of the same potato variety. As different varieties react differently to strains of virus X, it may be assumed that they carry the strain in different proportions, and that the average severity of strain mixtures is correspondingly affected. The effect on yield is probably the controlling factor limiting the multiplication of severe strains, while the partial segregation of mild strains in some tuber lines or families, which thus become higher-yielding, would be counterbalanced by the gradual emergence of severe strains, at first present in traces.

Recent work at Canberra suggests that the masked strain may not give complete protection against severe strains of virus X, and proof has been obtained that it can cause a 12 per cent. loss of yield. Therefore, the loss from even such a mild infection and the risk that infiltration of severer strains may occur must be balanced against the ease and cheapness of controlling greater losses by founding and maintaining stocks carrying a masked strain. In any case, regular, periodical selections from the parent stock to prevent a drift towards higher concentrations of severe strains and lower yields are to be recommended.

Krantz (F. A.), Tolaas (A. G.), Werner (H. O.), Goss (H. W.), & Jensen (J. H.). **The Kasota Potato.**—*Amer. Potato J.*, xx, 2, pp. 25–27, 1943.

Particulars are given of the Kasota potato (hybrid B5), which in five out of the six years of varietal testing for resistance to *Fusarium solani* var. *eumartii* in Nebraska [*R.A.M.*, xxi, p. 39], produced only one-third as many tubers with stem-end rot and vascular discoloration as Triumph and Cobbler. It is equally susceptible with Triumph to scab [*Actinomyces scabies*], but the pustules were rarely of the deep or pitted type. Its reactions to spindle tuber were comparable to those of other commercial varieties in Nebraska. Observations in Minnesota indicate that Kasota may be rather less susceptible to late blight [*Phytophthora infestans*] than the commonly grown varieties.

Snell (K.) & Geyer (H.). **Die zugelassenen deutschen Kartoffelsorten, ihre Erkennung, Unterscheidung und wirtschaftliche Bedeutung. 7. Aufl.** [The approved German Potato varieties, their recognition, differentiation, and economic importance. Seventh edition.]—91 pp., 35 figs., Berlin, P. Parey, 1942. Single chart RM.1.90. [Abs. in *Z. PflKrankh.*, lii, 12, p. 541, 1942.]

Included in the five German potato varieties officially approved in 1942 are two [unspecified in the abstract] resistant to the widespread biotype A of *Phytophthora infestans* [*R.A.M.*, xxii, p. 108], bringing the total number of sorts capable of withstanding late blight to five. In the case of each of the recognized varieties, its behaviour as regards 'degeneration' and reactions to 'Eisenfleckigkeit' and scab [*Actinomyces scabies*] are also indicated. Virtually immune from the last-named disease are Ackersegen, Carnea, Jubel, and Weisses Rössl, fairly resistant Edelragis, Erdgold, and Spätrot, and moderately susceptible Altgold, Centifolia, Frühbote, Konsuragis, Lichtblick, and Optima.

Dippenaar (B. J.). **Common scab, brown rot, and internal brown fleck of Potatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 213–218, 4 figs., 1943.

A brief account is given in popular terms of the symptoms and control of potato scab (*Actinomyces scabies*) [*R.A.M.*, xx, p. 380], brown rot or bacterial wilt (*Phytomonas* [*Bacterium*] *solanacearum*) [ibid., xx, p. 194], and internal brown fleck [ibid., xix, p. 585]. Against scab, disinfection with mercuric chloride (2 oz. in $12\frac{1}{2}$ gals. for one hour), formalin (1 pt. in 30 gals. for two hours), or aretan ($\frac{1}{2}$ minute) is recommended. Lime or ash should not be applied to soils with a P_H value of 5·2 or more and heavy applications of kraal manure may exert the same effect as lime. In a soil comparatively free from infection but with a P_H value exceeding 5·4 the planting of potatoes at intervals of two or three years is advised.

Control measures against *Bact. solanacearum* include the use of healthy seed, avoidance of cutting tubers when the stock is at all infected, avoidance of infected soil, roguing out of wilted plants if only isolated plants are affected in the field, and the application of sulphur (under specified recommendation from the nearest College of Agriculture) to reduce the P_H value to 4·0 or lower, since the bacteria quickly die out under this condition.

Internal brown fleck is not infectious and it is perfectly safe to plant affected

seed potatoes, provided the condition is not so severe as to affect the greater part of the flesh. The condition is of frequent occurrence in western Cape Province, sometimes in soils with P_H 6·8, i.e., soils not needing liming. Potatoes ripening in summer are very susceptible, and the disease is more prevalent on loam than on clay soils. Dunbar Standard is highly susceptible, but 40 to 50 per cent. occurrence has been observed in Arran Banner. In one instance, Dunbar Standard and King George, side by side, showed 50 and 0 per cent. incidence, respectively, though on other occasions the latter variety has been slightly affected.

Cook (H. T.) & Nugent (T. J.). **Potato scab in relation to calcium, soil reaction, and the use of acid-forming and non-acid-forming fertilizers.**—*Bull. Va Truck Exp. Sta.* 108, pp. 1785–1795, 1942.

Experiments carried out at Onley, Virginia, from 1938 to 1941, inclusive, to determine the effect of acid-forming and non-acid-forming fertilizers on the occurrence and severity of potato scab [*Actinomyces scabies*: *R.A.M.*, xviii, p. 475; xxii, p. 151] are described. Thirty-eight plots were used, each having received one of six different kinds of lime for five years. The soil was a sassafras sandy loam grading into a Keyport sandy loam, and the organic content averaged about 2·8 per cent., while the P_H values ranged from 4·5 to 5·4. The plots were divided longitudinally for the acid-forming and non-acid-forming fertilizer tests. The acid-forming fertilizer was applied to three rows on one side of the plot, and similar fertilizer neutralized with dolomitic limestone was applied to three rows on the other. In 1941, gypsum was applied to one row of every plot at the rate of 1,000 lb. per acre to determine whether increasing the calcium content of the soil without changing the reaction would increase scab.

The results obtained demonstrated that in all years except 1938 significantly more scab developed on the potatoes from the plots treated with non-acid-forming fertilizers than on those from plots treated with acid-forming fertilizers. This is explained by the fact that most of the soil samples from the acid-forming fertilizer plots had soil reactions unfavourable to scab, while most of the samples from the non-acid-forming fertilizer plots had reactions favouring the fungus.

When the data were divided according to soil reaction irrespective of the fertilizer used, there was significantly more scab on the potatoes from the sections with the higher soil reactions than on those from the sections with the lower soil reactions in all four years. This relationship was found when the samples from both the acid-forming and non-acid-forming fertilizer plots were analysed together, and when the samples from the plots treated with each kind of fertilizer were analysed separately.

Analysis of the data further showed that the addition of extra calcium caused no important change in soil reaction and no significant differences in the amount of scab present, with either acid-forming or non-acid-forming fertilizers.

It is concluded that the amount of scab present on potatoes is closely correlated with soil reaction, and only indirectly correlated with the fertilizer reaction or calcium content of the fertilizer in so far as the fertilizer changes the soil reaction. Calcium itself has no effect on scab development, and calcium compounds affect it only to the extent that they change the soil reaction.

Growers are advised to use a non-acid-forming fertilizer on soils the P_H value of which is 5 to 5·2 or under. Soils with P_H below 5 to 5·2 should also be limed sufficiently to bring the reaction to that level. On soils with reactions over P_H 5 to 5·2 acid-forming fertilizers should be used. Soils with P_H much above 5·2 which have previously produced infected potatoes should be planted to a different crop until the reaction has been reduced to P_H 5 to 5·2 by the continued application of acid-forming fertilizers for a number of years.

BRAUN (H.). **Biologische Spezialisierung bei Synchytrium endobioticum (Schilb.) Perc. (Vorläufige Mitteilung).** [Biological specialization in *Synchytrium endobioticum* (Schilb.) Perc. (Preliminary note).]—*Z. PflKrankh.*, lii, 11, pp. 481–486, 2 figs., 1942.

In August, 1941, a sample of potato tubers was submitted for inspection to the Biological Institute, Dahlem, Berlin, by the Thuringian Plant Protection Station, from a field reported to be totally infected by wart disease (*Synchytrium endobioticum*). Since the material was too extensively rotted by *Phytophthora infestans* to permit of a reliable identification of the variety concerned (alleged to be the wart-immune Ostbote), a local investigation of the affected area was carried out by an experienced member of the Institute staff. The stand was found, in fact, to consist mainly of the variety in question, with an admixture of Ackersegen, Prisca, and (?) Edda, the two former being free from the disease, while the last-named was severely attacked. In preliminary laboratory tests inoculation experiments with the Thuringian isolate of the fungus (designated G from the name of the locality of origin, Giessübel) gave positive results both on Ostbote and Edda, whereas the Dahlem strain (D), hitherto used for official varietal tests, caused no infection.

The existence of physiologic specialization in *S. endobioticum* being thus established in principle, further trials were conducted in the winter of 1941–2 with the new biotype on 67 varieties definitively or provisionally recognized as wart-immune. Of these, 58 proved to be susceptible and a further seven probably so, leaving only two resistant, namely, Fram and Frühe Hörnchen, both of which will of course require extended tests to confirm their presumed immunity. Of another 40 varieties, hitherto regarded as immune, but excluded from the seed-potato trade by the regulations of the Reich Food Board, 37 proved to be susceptible to race G, while Edelrot, Hellena, and Treff As presented some indications of resistance. Of 53 selections from the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, 12 appeared to be resistant to the new race, but here again further experiments will be necessary finally to establish their reactions. Exactly twice this number were resistant to race D, in which connexion it should be noted that, whereas G is capable of attacking varieties resistant to D, the converse does not hold good, all those resistant to D in the present series of experiments having been found susceptible to G. The high degree of aggressiveness of the new biotype as compared with the original one is thus amply apparent.

The range of physiologic specialization within *S. endobioticum* is not, however, exhausted by biotypes D and G, a third one (SB) being represented in material received from [C.] Blattný and originating in southern Bohemia (Czechoslovakia). Of 66 recognized German varieties inoculated with this race, 32 were immune (again including Fram and Frühe Hörnchen), 13 and 7 were unmistakably and probably susceptible, respectively, while the remaining 14 may be ranked as 'border-line' varieties. A table is given showing the reactions of seven varieties to the three biotypes of *S. endobioticum* under discussion. Fram is immune from all three, Edda, Edelragis, and Parnassia susceptible to G but immune from SB and D, while Primula, Sabina, and Sickingen are susceptible to G and SB but immune from D.

If the aggressive new biotypes remain restricted to their present narrow zone of incidence, they should soon be eliminated by the legislation providing for the exclusive cultivation of immune varieties as from 1st March, 1941 [*R.A.M.*, xix, p. 320], but even should their distribution become wider, the prompt notification of each new focus of infection, as required by the operative regulations, should ensure the rapid identification and eradication of the particular biotype concerned.

Holmberg (C.). **Potatiskräfta och Potatisål i Sverige under 1942.** [Potato wart and Potato eelworm in Sweden during 1942.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 1, pp. 14–16, 1 map, 1943.

During 1942, 146 new cases of potato wart [*Synchytrium endobioticum*] were registered throughout Sweden, compared with only 33 in 1941 [*R.A.M.*, xxii, p. 109]. The fresh foci of infection are situated mostly in the south, 116 being in Scania, where the Kristianstad district is particularly severely affected; in this area the number of cases (98) detected in the one year under review almost equals the total for the period from 1928 to 1941.

Murray (R. K. S.). **Botanical and Mycological Department.**—*Rep. Rubb. Res. Bd Ceylon, 1941*, pp. 7–15, 1942.

The decisive influence of atmospheric temperature on the incidence of *Oidium* leaf disease of rubber [*O. heveae*] was again demonstrated in 1941 [*R.A.M.*, xxi, p. 97], the pathogen being almost absent during February and the first half of March, when abnormally high temperatures prevailed in the low country both in the daytime and at night. With the onset of wet and cooler weather after the middle of March late-wintering trees contracted infection. Information from mid-country estates denoted that the attack was relatively mild below an elevation of some 1,500 ft., above which level the usual extensive defoliation was observed. Under these conditions it was necessary to maintain the standard schedule of sulphur-dusting treatments, which could safely be reduced or altogether dispensed with at lower altitudes. A 'museum' collection of clones from individual trees showing resistance to *O. heveae* was established on an estate at Matale, about 1,500 ft. above sea-level, the first planting of 37 clones having been completed during the north-east monsoon. In a small-scale test the addition of soda ash to sulphur in the ratio of 20 : 80 exerted no detrimental action on the flowers, both the mixture and sulphur alone increasing the set of seed by protecting the inflorescences from mildew. This treatment, therefore, would be unlikely to assist in the control of the pod and leaf rot caused by *Phytophthora palmivora* through a reduction in the amount of susceptible material available to the pathogen. The continuous wet weather also favoured the other forms of infection by *P. palmivora*, i.e., canker, bark rot, and die-back of the terminal shoots of young plants, while pink disease [*Corticium salmonicolor*] was likewise unusually prevalent in immature areas.

Martin (T. L.), Anderson (D. A.), & Goates (R.). **Influence of the chemical composition of organic matter on the development of mold flora in soil.**—*Soil Sci.*, liv, 4, pp. 297–302, 4 graphs, 1942.

The changes occurring in the chemical composition of organic materials, viz., sweet clover [*Melilotus alba*], lucerne, whitetop (*Lepidium draba*), Russian thistle (*Salsola pestifer*), wheat straw, and maize fodder during the process of decomposition in a dark grey, sandy loam Utah soil appear to induce corresponding alterations in the mould flora [*R.A.M.*, xxii, p. 110]. The higher the percentage of readily decomposable carbohydrates, e.g., sugars, starches, and some hemicelluloses and celluloses, the greater is the predominance of *Mucor rouxii* and *Rhizopus nigricans* in relation to other moulds present in the soil-organic matter mixture. With the decline in the incidence of these species, from the 60th day onwards, corresponding to the production in the soil of a stable hemicellulose and cellulose fraction, *Penicillium glaucum* and *Aspergillus niger* assume greater prominence, while about the 100th day, when lignin was the chief constituent remaining of the original plant material, *Cladosporium*, *Alternaria*, and *Aspergillus minutus* began to develop, their incidence reaching a peak from the 120th to 140th.

BRANDENBURG (E.). **Mangelkrankheiten als Gegenstand phytopathologischer Forschung.** [Deficiency diseases as the object of phytopathological research.]—*Z. PflKrankh.*, liii, 1–3, pp. 19–24, 1943.

Some of the outstanding advances made during the past 15 years in the recognition and control of deficiency diseases of plants are reviewed. The discovery of the so-called ' trace ' elements, manganese, boron, and copper in the soil opened up an entirely new phase in the study of disorders caused by their absence or shortage, e.g., heart and dry rot of beets, reclamation disease of oats and other crops, and marsh spot of peas, associated, respectively, with boron, copper, and manganese deficiency. References to all the investigations mentioned have appeared from time to time in this *Review*. The field of research on disturbances of the type under discussion is thought to be by no means exhausted, the etiology of various fruit and vine chloroses in relation to iron, for instance, urgently requiring further elucidation. Deficiency diseases constitute, as it were, a border-line problem in the solution of which experts in matters relating to phytopathology, the physiology of nutrition, soil biology, and the use of synthetic fertilizers may fruitfully co-operate.

KOVAČEVSKI (I. C.). **Die Buntblättrigkeit der Paprikapflanze (Capsicum annuum) (Medicago virus 2 K. Smith var. typicum Black u. Price). Vorläufige Mitteilung.** [Mosaic of the Chilli plant (*Capsicum annuum*) (*Medicago* virus 2 K. Smith var. *typicum* Black & Price). Preliminary note.]—*Z. PflKrankh.*, lii, 12, pp. 533–540, 7 figs., 1942.

Chilli mosaic [*R.A.M.*, xix, p. 254; xxi, pp. 324, 408] is stated to be very widespread in Bulgaria, up to 30 or 40 per cent. of the plants in almost every stand inspected during the late summer being affected. The most prominent feature of the disorder are the conspicuous, sharply defined, white or yellow lesions, more aptly termed zones, which are mostly uniformly distributed over the leaf blade, with a frequent tendency to elongation in proximity to the veins. Generally speaking, the size of the lesions and the intensity of their coloration decrease from the base upwards, the shade ranging from greenish-white to lemon-yellow on the lower and middle leaves, on which the spots resemble those of the aucuba or calico viruses of potato, whereas on the apical foliage the small, inconspicuous mottling might easily be confused with that caused by the viruses of cucumber or tobacco mosaic or potato virus Y. Malformation and curling may occasionally be observed on leaves attacked at an early stage of development.

Quite another type of symptom is encountered in some cases, especially in inoculation experiments. A more or less vivid yellow zone radiates from the leaf tip or the upper leaf margins towards the midrib, gradually diffusing into the intervenal spaces, which turn completely yellow, sometimes with the exception of a narrow, green zone. The discoloration may also originate at the base of the leaf and extend upwards. Much rarer is the development of a pattern consisting of densely clustered rings or parallel zig-zag lines, imparting to the leaf a striking tortoiseshell effect, somewhat resembling that induced on the chilli plant by cucumber mosaic. Necrosis has so far only been encountered in inoculated plants in the form of brownish, circular, arcuate, or zig-zag lesions on the leaves and short, necrotic stripes on the stem and petioles. The distortion of the fruits occasionally noted on plants affected by mosaic is very similar to that caused by cucumber mosaic, and setting may be considerably reduced, but in spite of the intensive disorganization of the chlorophyll accompanying this disease, it is much less detrimental to the chilli than the cucumber or tobacco mosaic viruses.

Chilli plants in the greenhouse were inoculated with juice from variegated chilli, potato suffering from calico, and lucerne affected by mosaic [ibid., xix, p. 563], the percentage of positive infections ranging from 0 to 90 but generally averaging under 30, while rubbing was uniformly essential and the incubation period fairly lengthy—

10 to 15 days or upwards. Only in one out of three series of aphid transmission tests were three out of six plants successfully infected by means of *Myzus persicae*. Potted lucerne plants, rubbed with juice of a mosaic chilli, contracted infection almost as rapidly as the original host, but at the high temperatures of the greenhouse the resultant symptoms soon became masked. Although Samsun and White Burley tobacco, *Nicotiana glutinosa*, and *Datura stramonium* were included in nearly all the trials, mosaic developed only in two Samsun plants and one *D. stramonium*. Potatoes responded negatively to all attempts at infection. The virus is less aggressive in its attacks on chilli than any other affecting this host in Bulgaria, excepting potato virus Y, but its prevalence is explained by the large number of hosts serving as sources of inoculum.

The results of these experiments are considered to point to *Medicago* virus 2 K. Smith var. *typicum* Black & Price [lucerne mosaic: ibid., xix, p. 563] as the cause of chilli mosaic in Bulgaria, where potato calico (var. *solani*), the other possible agent, has only once been encountered on Odenwälder Blaue plants raised from imported seed.

RANGASWAMI [IYENGAR] (R. S. S.) & GRIFFITH (A. L.). **Demonstration of Jassus indicus (Walk) as a vector of the spike disease of Sandal (Santalum album, Linn.).**—*Indian For.*, lxvii, 8, pp. 387–394, 4 pl., 1941.

In a further experiment on the transmission of sandal spike [*R.A.M.*, xx, p. 133] at Javalgiri, North Salem (Madras), four out of eight healthy two-year-old sandal plants (one parasitic on *Acacia farnesiana* and the other three on *Mundulea suberosa*), placed in a cage into which 29 individuals of *Jassus indicus* were released between 30th June and 16th August, 1940, manifested the typical symptoms of the disease between October and December, the minimum and maximum incubation periods being 102 and 122 days, respectively. In the same cage was a disease-masking sandal plant on *Solanum seaforthianum* which provided the infective material. A healthy plant grafted with disease-masking material from one of the experimentally infected ones on 26th January and 23rd February, 1941, showed spike symptoms on 28th April, i.e., 91 days from the first and 64 from the second set of grafts, the previous minimum and average periods for the appearance of symptoms in grafted plants having been determined as 31 and 138 days, respectively. On the same date one of the caged plants was already dead and the other three obviously in a declining condition. In a further test in November and December, 1940, suspicious symptoms developed in the following June on four out of seven plants caged with *J. indicus*.

BELL (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1941–42*, pp. 12–13, 1942.

In this report on sugar-cane disease work in Queensland during the period under review [*R.A.M.*, xxi, p. 303], the author states that gumming disease (*Bacterium* [*Xanthomonas*] *vasculorum*) is rapidly vanishing from the known areas of infection in the Mulgrave and Hambledon districts. After the remaining fields of S.J.4 have been ploughed out at the close of the present season, incidence should be very light.

The absence of the normal wet monsoon season in 1942 reduced the natural transmission of downy mildew [*Sclerospora sacchari*], and provided an opportunity to clean up a number of infection centres. Scattered stools of non-approved susceptible varieties are still found on certain farms, and it will not be safe to reintroduce P.O.J. 2878 until these have all been removed.

A conspicuous improvement as regards Fiji disease was again seen in the Maryborough area, where, in selected localities, the reintroduction of susceptible varieties has already begun. Inspection of 7,178 acres in the Isis district during the year ending 31st March, 1942, revealed the presence of only 63 affected stools

on 10 farms. In the Bundaberg district, 35,179 acres were inspected, and 4,777 diseased stools were found, which represents a loss of about 0·0025 per cent. of the district crop. Control of Fiji disease is much more difficult in the Moreton district, owing to the absence of autumn planting, the greater proportion of stand-over cane, and better growing conditions. Loss of crop is, however, so far negligible. In the Fiji disease resistance trial now approaching completion it has become apparent that the Hawaiian canes 28–4291, 31–2484, 31–2806, and 32–8560 all possess high susceptibility, while Q. 28 appears to be very resistant. No sign of infection has been noted on either *Saccharum robustum* Tank or *S. robustum* Burma.

Owing, probably, to increased planting of the Oramboo variety, leaf scald (*Bact.* [*X.*] *albilineans* was more prevalent than before in North Queensland. It is important only in wet areas, diseased stools tending to die out in areas where the soil is dry during spring.

Because of the failure of the usual monsoonal late-summer rains, red stripe [*X. rubrilineans*] and top rot were not at all prevalent, but the dry spring of 1941 induced some stem rot in over-mature canes. In a field at Meringa, where patches of severe top rot were present, the moisture equivalent was found to be low in these patches. Heavy dressings of filter press mud were made on these places, with the result that top rot gradually declined.

In field germination studies preliminary tests with various substances under ordinary and relatively aseptic conditions indicated that while none exercised any direct stimulation, some greatly delayed internal rotting of the seed piece. The best mercurials effectively increased rate and percentage of germination under conditions of low temperature and soil moisture, in which germination is normally retarded. Strong protective action [against rotting] was observed when treated and untreated setts were planted in soil previously inoculated with the spores of *Thielaviopsis* [*Ceratostomella*] *paradoxa*.

Forbes (I. L.) & Dufrénoy (J.). **Internal breakdown of Sugar Cane associated with mosaic.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 3–4, 1943.

In 1941, 22 mosaic-diseased stalks of the C[anal] P[oint] 33/243 sugar-cane variety were observed to be affected by a breakdown and collapse of the central pith cells in well-marked, elongated areas in some, but usually not all, of the internodes between the base and top of the stalk. In the same season over 200 stalks of mosaic-free cane were free from internal breakdown. In 1942 all 64 mosaic stalks suffered from breakdown, while two out of 39 apparently healthy ones each showed a very small lesion, the development of which coincided with foliar mosaic, indicating a connexion between the two symptoms. Sections through the lesions revealed the diffusion of the vacuolar contents (mostly phenol compounds) into the intercellular spaces, which, together with the cell walls, stain deep red with chlorhydric phloroglucin, while the residual material left in the cells flocculates into a brown sediment and settles at the bottom. Internal breakdown is stated to have occurred in other varieties in the past.

Fitzpatrick (H. M.). **Revisionary studies in the Coryneliaceae. II. The genus Caliciopsis.**—*Mycologia*, xxxiv, 5, pp. 489–514, 35 figs., 1942.

The author supplies a diagnosis of the genus *Caliciopsis* with notes, descriptions, and a key to its ten species, of which two are new to science.

Miller (J. H.) & Burton (M. Gwendolyn). **Studies in some Venezuelan Ascomycetes collected by C. E. Chardon and A. S. Müller.**—*Mycologia*, xxxv, 1, pp. 83–94, 10 figs., 1943.

Dothiora subtropica, parasitic on stromata of *Bagnisiopsis* on Melastomaceae in the tropics, and other species are discussed in relation to problems of the phylogeny

of the Ascomycetes. *Mycosphaerella venezuelensis* n. sp. is described on leaves of *Canavalia ensiformis* from Venezuela.

Bose (S. R.). **Moisture-relation as a determinant factor in the transformation of the basidia of certain Polyporaceae.**—*Mycologia*, xxxv, 1, pp. 33–46, 8 figs., 1943.

The phenomenon, previously observed by the author in *Ganoderma lucidum* and a number of other Polyporaceae [*R.A.M.*, xiv, p. 611], of the transformation of basidia into hyphal elongations with terminal spores exactly like basidiospores at the end of the rainy season or during intervals between rains, and, later, their reversion into basidia on the advent of rain, has been reproduced experimentally during 1938 and 1939. Consistent results were obtained with thin and easily desiccated specimens of species of *Polyporus*, *Polystictus*, and *Trametes*: when dry pieces of the fruit bodies were placed in running water from a laboratory tap overnight the hyphal elongations entirely disappeared from the pore tubes, giving place to mature basidia with sterigmata and spores, whereas in pieces of the same fruit body stuck to the lid of a moist agar plate and sectioned daily it was found that as the condensation water gradually disappeared in the course of three or four days and the relative humidity of the plate became reduced to about 85 per cent. a large number of clamped and elongated hyphae with terminal spores and a few abnormal elongated narrower basidia developed in the pore tubes. When the test pieces were exchanged and the experiment repeated, the same result was obtained. The experiment did not succeed well with very thick or soft specimens of *Polyporus*, *Trametes*, *Lenzites*, *Daedalea*, *Fomes*, and other species, for all specimens do not withstand desiccation to the same degree.

It is concluded that the transformation of basidia into hyphal elongations with clamp-connexions and terminal spores and its reversal are mainly controlled by the water relation. In some specimens of *G. lucidum* collected in 1937 and 1938, brown thick-walled basidia, resembling those described in *Podaxis indicus* and *P. aegyptiacus* under the name of pseudobasidia, were found in the hymenial layer.

Knight (C. A.). **The sulfur distribution in the rib-grass strain of Tobacco mosaic virus.**—*J. biol. Chem.*, cxlvii, 3, pp. 663–666, 1943.

Analysis of the rib-grass [*Plantago lanceolata*] strain of tobacco mosaic indicated that its sulphur content amounts to 0·62 per cent., or about three times the proportion of this element found in the ordinary strain [*R.A.M.*, xxii, p. 44], whereas the cysteine content of the former, measured by three methods, is apparently the same as in the latter, i.e., 0·68 per cent. Quantitative analysis by two methods, however, revealed the presence in the rib-grass strain of 2 per cent. methionine, which was shown by qualitative tests to be absent from the seven other strains of tobacco mosaic examined. All or virtually all the sulphur present in the rib-grass virus is believed to be accounted for in its cysteine and methionine contents.

Smith (T. E.) & Clayton (E. E.). **Control of Granville wilt (Bacterium solanacearum) of Tobacco and other plants by applications of urea to the soil.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 11–12, 1943.

Applications of urea in the form of uramon (42 per cent. nitrogen) were made in triplicate to the soil of three-row plots, 109 ft. long, naturally infested by *Bacterium solanacearum* [*R.A.M.*, xxii, p. 133] in which tobacco was growing, at dosages of 250, 500, and 1,000 lb. per acre, the material being broadcast over the surface and disked into the soil to a depth of 6 in. On 1st August, 1942, 80, 68, and 13 per cent., respectively, of the plants treated at these rates on the previous 17th October were

wilted, the corresponding figures for those given the same amounts of the disinfectant on 24th March, 1942, being 49, 34, and 3 per cent., respectively. In another test the application of uramon, ten weeks before planting, to plots of infested soil of tobacco, tomato, potato, eggplant, chilli, *Petunia*, black nightshade [*Solanum nigrum*], and castor bean [*Ricinus communis*], at 500 and 1,000 lb. per acre, effectively combated the pathogen and, in fact, almost eliminated it at the stronger dosage, whereas the untreated stands of the more susceptible species were wilted by 1st August.

CLAYTON (E. E.) & STEVENSON (J. A.). **Peronospora tabacina Adam, the organism causing blue mold (downy mildew) disease of Tobacco.**—*Phytopathology*, xxxiii, 2, pp. 101–113, 1 graph, 1943.

Among the problems confronting mycologists in connexion with tobacco downy mildew (*Peronospora tabacina*) are (1) the present position with regard to identification methods for the organism in question and other Peronosporaceae; (2) the source of infection in the United States; and (3) the reason for the temporary disappearance of the disease following the sudden outbreak of 1921.

Of 30 collections of diseased leaves of various species of *Nicotiana* grown under uniform greenhouse conditions from October, 1940, to April, 1941, 23 differed significantly in conidiophore length, and 25 in the length or breadth, or both, of the conidia, from the 'grand mean' derived from 40 collections of infected tobacco foliage. The range of means for the conidia was found to extend from 17 to 28 by 13 to 17 μ, these differences being too wide to allow of definite identification by measurements. Again, the marked variations in oospore size (mean of 27·8 to 39·9 for nine collections) preclude the use of this character as a taxonomic criterion, unless to place the organs within the limits for the genus (20 to 60 μ). No aid to specific determination is afforded by the morphology of the conidiophores, conidia, or oospores of *P. tabacina*, which are devoid of distinguishing characters, and the only definite basis of identification appears to be the pathogenicity of the fungus, which is virtually confined to the genus *Nicotiana*. There seems to be no convincing evidence of the existence of more than one species of *Peronospora* parasitic on *Nicotiana*, and the name accepted for this organism is *P. tabacina*.

The fungus is believed to be endemic in all the temperate-zone regions to which *Nicotiana* is indigenous, i.e., parts of North and South America and Australia.

Failure to form oospores in 1921 is thought to have been the cause of the non-recurrence of the pathogen in 1922 in the Georgia–Florida tobacco-growing regions.

HOPKINS (J. C. F.). **Mycological Notes. 16. The campaign against the kromnek virus.**—*Rhod. agric. J.*, xl, 1, pp. 47–49, 1943.

Investigations carried out in Southern Rhodesia in 1940 showed that the 'kromnek' virus [tomato spotted wilt: *R.A.M.*, xx, pp. 85, 282; xxi, p. 354] was widely distributed in Bulawayo, spread having resulted, apparently, from the sale of infected *Dahlia* tubers. Affected *Dahlia* plants were found in 18 of 20 gardens inspected in the suburbs. Because of the potential danger to tobacco areas, an appeal was made to the gardeners of Bulawayo to refrain from distributing *Dahlia* tubers, and, in addition, quarantine restrictions were placed on nurseries [ibid., xix, pp. 568, 576]. It was then suggested that the complete destruction of all the *Dahlia* plants in the town would be the ideal means of control, and the great majority of growers did, in fact, comply with this suggestion.

The following season a house-to-house inspection was made, together with a detailed inspection of nurseries. It was ascertained that the destruction of *Dahlia* plants on private properties had almost completely checked the disease before it became established on alternate hosts, but that in spite of the destruction of all

such plants in public gardens (where the disease had been present for two seasons), kromnek had spread to many other plants, including many perennials and weeds.

A study of the symptoms on different hosts indicated that all concentric ring, diamond, or fern-leaf patterns, particularly if associated with the leaf veins, were symptoms of kromnek. There was thus strong circumstantial evidence that the following were alternate hosts: *Impatiens balsamina*, *Celosia*, *Cassia floribunda*, *Agapanthus*, *Calendula officinalis*, screw pine (*Pandanus* sp.), *Cestrum*, *Coreopsis*, *Solanum seaforthianum*, and black jack (*Bidens pilosa*), all of which showed yellow or white rings, diamond and line patterns, etc.; *Browallia*, *Scabiosa*, *Zinnia*, and *Pentstemon*, which showed yellow blotches with or without rings and stem-twisting; *Campanula*, *Viola*, ivy-leaf geranium (*Pelargonium*), and *Dieffenbachia*, which showed pale green and yellow rings and mosaic mottling; aster (*Callistephus*) [*chinensis*], African marigold (*Tagetes erecta*), *Brunfelsia*, and *Primula obconica*, which showed stunting, distortion of the young leaves, and yellow mottling; and nasturtium [*Tropaeolum majus*], which showed a pale green, indefinite pattern following the veins, yellow and green mottling, and cupping of the foliage.

A strenuous policy of eradication and destruction was taken up, but the disease reappeared in November, 1941, in *Zinnia* seedlings raised in the nursery to test for the presence of the condition. A few *Brunfelsia* seedlings showing mottling and distortion of the foliage were growing a few yards away, and three small plants of *Pandanus utilis* were also present, and were suspected. All these were destroyed. At the same time kromnek reappeared in *Primula obconica* in the greenhouse, spread, apparently, having occurred from a young screw pine. The primulas and the screw pine were destroyed, and no case of infection has since been observed in the public gardens.

In Bulawayo itself the position remained good until January, [1942], when affected *Dahlia* plants were found in a nursery. Some tubers from these were sold and have not yet been traced. A number of plants from the affected tubers were, however, examined, with the result that the following varieties were ascertained to be affected: Eagle Rock Fantasy, Normandie, Jersey White Beauty, Fireman, Winoka, The Rosary, Flammander Sonne, Royal Flush, Rev. A. J. Norton, Lady Stonehaven, and (suspected) Aimee Hodgens. All tubers of these varieties from the infected nursery are assumed to be affected, and the Agricultural Department desires to trace their distribution.

DIPPENAAR (B. J.). **The control of virus diseases in Tomatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 163–164, 168, 1943.

Brief, practical directions are given for the control of virus diseases of tomatoes in South Africa, particularly spotted wilt, mosaic, and a condition causing dying-back of the tips of shoots and brown streaks on the stems, which are stated to be those most prevalent in the Stellenbosch–Elsenburg area. The control measures listed, which have given fairly successful results in experimental tests, are as follows. Seed-beds should be made on fresh soil some distance away from flowers and vegetables and remote from potato and tobacco lands. The surrounding grass, weeds, or bushes should be dusted with fine sulphur. When about 1 in. high, the tomato plants should be given a thorough application of nicotine or sulphur dust, care being taken not to introduce too much sulphur into the soil. After this, nicotine and sulphur dustings must alternate at weekly intervals up to transplanting time. Just before transplanting, the seed-beds may be copiously dusted with sulphur. Sulphur dust should again be applied three weeks after transplanting, the treatment being repeated two or three weeks later. The plants should be examined about three weeks after transplanting, and every 10 days afterwards, all affected plants being removed and destroyed. Roguing can be discontinued when the plants have attained half their full height.

HÄNDLER (E.). **Über die Braunfleckenkrankheit der Tomate.** [On the leaf mould disease of the Tomato.]—*Kranke Pflanze*, xix, 9–10, pp. 91–93, 2 figs., 1942.

The essential information concerning tomato leaf mould (*Cladosporium fulvum*), which was, as usual, prevalent in glasshouses at Pillnitz (Elbe Valley) in 1942, is briefly summarized, and directions are given for its control by cultural measures, directed primarily against the formation of dew on the leaves, supplemented where necessary by fungicidal treatments, e.g., spraying with 0·75 to 1 per cent. solbar or 2per cent. lime-sulphur, or vaporization of the houses with the 'sulfurator' apparatus [*R.A.M.*, xv, p. 298 *et passim*] (A. Treppens & Co., Lindenstrasse 13, Berlin, SW. 68), using 500 gm. sulphur per 1,000 cu. m. Bulbosan, a new dust product of the J. G. Farbenindustrie, free from both copper and sulphur, is also reported to have given good control of *C. fulvum*. None of the tomato varieties grown commercially has given any marked indication of resistance to leaf mould, though Lucullus is reputed to withstand the disease somewhat better than Tuckswood.

ALBEN (A. O.) & HAMMAR (H. E.). **Progress report on soil applications of zinc sulphate in the control of rosette of Pecan.**—*Proc. Tex. Pecan Grs' Ass.*, xxi, pp. 63–70, 1941. [Abs. in *Biol. Abstr.*, xvii, 3, p. 873, 1943.]

Pecan rosette generally yielded in the course of two years to heavy applications (150 to 200 lb. per sq. ft. of a cross-sectional area of the trunk,) of zinc sulphate [*R.A.M.*, xix, p. 736] on slightly acid sandy and heavy alkaline soils in Texas. Previous experiments had shown that smaller amounts of the compound failed to give adequate control. The combination of sulphur and manure with the zinc sulphate on the heavier soil types and of manure alone on those of sandy texture may enhance the value of the chemical in the control of the trouble.

HAHN (G. G.). **Taxonomy, distribution, and pathology of Phomopsis occulta and P. juniperovora.**—*Mycologia*, xxxv, 1, pp. 112–129, 2 figs., 1943.

In comparable wound inoculation tests carried out during 1941 in an unheated greenhouse in the Marsh Botanical Garden, Yale University, New Haven, Connecticut, monospore cultures of *Phomopsis occulta* [*R.A.M.*, xx, p. 551], obtained from both wildling and nursery stock, failed to infect any of the 14 wildling eastern red cedar (*Juniperus virginiana*) saplings inoculated, whereas inoculations with *P. juniperovora* [loc. cit.] were entirely successful in all seven saplings used. Of these seven, those of a bluish-green colour were girdled and killed, whereas others, of a lighter and brighter green showed some resistance, the palest green tree among them developing only non-girdling cankers and no discoloration of lateral branches. Re-isolations of *P. juniperovora* on synthetic malt agar yielded the yellow colour and flaming orange crystals typical of the growth of this fungus on a number of media. These two characters, which do not appear in cultures of *P. occulta*, are considered the safest means of differentiating these two species, since their spore size ranges tend to overlap. *P. occulta* is stated to be widely distributed on conifers both in western Europe and throughout North America, while its perfect stage, *Diaporthe conorum*, though common in Europe, is very rare in the Western Hemisphere.

In the course of the author's investigations in Great Britain from 1926 to 1929, fruiting bodies of *D. conorum* were obtained experimentally on twigs of English elm (*Ulmus procera*) from monopycnidiospores of the fungus originally isolated from cultures of monoascospores of *D. conorum* from Douglas fir [*Pseudotsuga taxifolia*]. These data, published now for the first time, are thought to support Wehmeyer's opinion of the relationship of *Diaporthe* species on conifers to *D. eres*, although the homothallic *D. conorum* holds priority. *P. occulta* is considered to be a secondary invader of cedars following some injury to the host plant, although some

strains of it were found to be capable of weak parasitism on the coast form of Douglas fir. The pathogenic species, *P. juniperovora*, the *Diaporthe* stage of which is as yet unknown, is stated to be parasitic under natural conditions only on hosts belonging to the genera of the Cupressaceae, a revised list of which is given. Under experimental conditions saplings of the coast form of Douglas fir were found to be highly susceptible to this fungus, but nursery stocks of this host were never observed to be attacked. The fungus is stated to occur as a nursery parasite in Europe and in the United States. The first, and so far the only, record of *P. juniperovora* on wildling red cedars refers to a small number of fruiting bodies collected and identified in culture by the author and Dr. Wright in Nebraska.

MILLER (J. K.). **Fomes annosus and Red Cedar.**—*J. For.*, xli, 1, pp. 37–40, 1943.

This is a report on the writer's six-year study in the Duke Forest, North Carolina, on the part played by *Fomes annosus* in the death and decay of the red cedar (*Juniperus virginiana*). The fungus was found to be capable of killing trees of all ages from the seedling stage to maturity, besides causing a pocket rot of the stem base and thereby reducing the value of butt logs sold to the manufacturer. Damage is particularly severe in plots in which the cedar is grown as an under-story tree, over-topped by other species and so deprived of its necessary quota of sunlight, and control should be based on the avoidance of these conditions in the choice of a site. In two instances fructifications of *F. annosus* were observed on two species growing in proximity to red cedars, from which they had spread by means of extensively branching, white mycelial strands, viz., *Liquidambar styraciflua* and *Rhus toxicodendron*, but penetration was not effected.

The fungus was shown in laboratory experiments to produce the following enzymes: asparaginase, catalase, cellulase, emulsin, erepsin, inulase, laccase, ligninase, pectinase, pepsin, peroxidase, sucrase, tanninase, trypsin, tyrosinase, and zymase.

DILLER (J. D.). **A canker of eastern Pines associated with Atropellis tingens.**—*J. For.*, xli, 1, pp. 41–52, 3 figs., 1 diag., 1 graph, 1 map, 1943.

General field observations in the eastern United States, covering a period of seven years, together with the data from permanent sample plots in planted and natural stands of slash pine (*Pinus caribaea*), indicate that the canker caused by *Atropellis tingens* [*R.A.M.*, xxii, p. 187] has been responsible for only negligible damage. Even in the epidemic years of 1933 and 1934, when severely infected trees lost up to one-third of their crowns, no curtailment of height and diameter increment ensued. Besides slash pine, the following species of eastern pine are liable to infection by *A. tingens*: *P. banksiana*, *P. clausa*, *P. echinata*, *P. pungens*, *P. resinosa*, *P. rigida* and its var. *serotina*, *P. strobus*, *P. taeda*, and *P. virginiana*, while two native western (*P. contorta* and *P. ponderosa*) and four introduced species (*P. densiflora*, *P. nigra*, *P. pinaster*, and *P. sylvestris*) are also subject to attack. Twenty States have been found to harbour the fungus, namely, Alabama, Arkansas, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Missouri, New Hampshire, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia.

RENNERFELT (E.). **Die Toxizität der phenolischen Inhaltsstoffe des Kiefernkernholzes gegenüber einigen Fäulnispilzen.** [The toxicity of the phenolic ingredients of Pine heartwood to some rot fungi.]—*Svensk bot. Tidskr.*, xxxvii, 1, pp. 83–93, 1 fig., 2 graphs, 1943.

The phenolic substances, pinosylvin and pinosylvin monomethylether, occurring in pine heartwood, were tested in malt agar cultures at 22° C. for their fungicidal properties and found (the former in particular) to exert a strongly toxic action on certain wood-destroying fungi. Thus, a concentration of 0·01 per cent. pinosylvin

sufficed to arrest the growth of *Polyporus betulinus* and *Polystictus hirsutus*, while *Schizophyllum commune* was somewhat more resistant, developing to a slight extent in the presence of 0·02 per cent. of the phenol, and *Fomes annosus* only succumbed to a dosage of 0·1 per cent. Pinosylvin itself was about 20 times as toxic to *F. annosus*, *P. hirsutus*, and *S. commune* as its monomethylether, whereas *Polyporus betulinus* was equally sensitive to both substances. The phenol coefficient of pinosylvin is five to ten times that of the monomethylether. Pine heartwood blocks impregnated with the latter were much less severely attacked by *Lentinus squamosus* than the untreated controls, but in the case of *F. annosus* little difference was observed between the two series.

LUDBROOK (W. V.). **Fertilizer trials in southern New South Wales Pine plantations.**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 307–314, 1942.

Large-scale experiments carried out in New South Wales on the control of pine-tree needle fusion [*R.A.M.*, xxii, p. 231] by dressings of superphosphate, rock phosphate, and boron compounds showed that affected *Pinus caribaea* and *P. taeda* trees failed to respond to phosphatic fertilizers during the first season after treatment, but during the next three seasons the treated trees showed a much higher percentage of recovery than the untreated. Boron compounds reduced the symptoms much more rapidly than superphosphate, but the effect generally lasted for only one season. During the second and third seasons after broadcasting phosphatic fertilizers under the trees, marked responses in volume increment and in recovery from needle fusion were shown by *P. caribaea* and *P. taeda* in one locality, though in another, treatment of *P. taeda* with 2½ cwt. superphosphate per acre was ineffective, possibly owing to drought. In the Moss Vale area 1½ or 3 cwt. superphosphate per acre had little or no effect on *P. radiata* trees 7, 9, and 17 years old, during three seasons after application. The same treatments, however, produced 35 per cent. increase in height growth, as compared with the untreated controls, in one-year-old self-sown seedlings on a burnt area at Penrose, during the season after application. This was maintained in the next season in the case of plots given the heavier application.

BENATAR (R.). **Algumas observações sobre a hernia das cruciferas.** [Some observations on the 'club root' of crucifers.]—*Bol. Esc. nac. Agron., Rio de J., 1941*, 2, pp. 281–301, 8 figs., 1942. [English summary.]

The writer's studies on club root in crucifers, *Plasmodiophora brassicae* [*R.A.M.*, xxii, p. 40], were based on fixed and stained material of *Brassica acephala*. Accounts are given of the mode of propagation of the plasmodia through the host cells, the formation of tumours in the hadrocentric vascular bundles, and the morphological modifications induced in the structure of the host cell by contact with the encircling plasmodia.

GREEN (D. E.) & ASHWORTH (D[OROTHY]). **Club root of Brassicas—a test on its control.**—*J. R. hort. Soc.*, lxviii, 4, pp. 111–115, 1943.

The best control of club root (*Plasmodiophora brassicae*) on crucifers of various kinds in a test at Wisley, Surrey, in 1942 was obtained by raking into the soil just before sowing 4 per cent. calomel [mercurous chloride] dust at the rate of 1½ oz. per sq. yd., which reduced the incidence of infection in Ellam's Early, Harbinger, and Offenham cabbages, swedes, turnips, and kohlrabi from 74, 40, 80, 65, 12, and 78 per cent. in the untreated control plots to 3, 3, 0, 36, 0, and 16 per cent., respectively, at the counts made from 9 to 18 weeks after sowing [cf. *R.A.M.*, xi, p. 146; xxi, p. 177]. The corresponding figures for proprietary substances A and B (the former containing calomel dust), applied in the same way and at the same strength as the foregoing, were 18, 11, 7, 50, 4, and 23, and 8, 6, 27, 44, 0, and 4 per

cent., respectively. The results secured with hydrated lime (1 lb. per sq. yd.) and mercuric chloride (1 in 2,000, watered in drills across the plot, 1 pint per 5 ft.) were in general less satisfactory, though both completely eliminated the disease from the turnip stands, and the action of lime, moreover, is known to be slow. Early Market radishes were included among the trial plots but remained entirely free from club root [cf. ibid., xvi, p. 223], suggesting the possibility of physiological specialization within the fungus.

Gram (E.) & Bovien (P.). **Rodfrugternes Sygdomme og Skadedyr.** [The diseases and pests of root crops.]—125 pp., 48 pl., Copenhagen, Danish Agricultural Society, 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, pp. 141–142, 1943.]

Recent advances in the technique of colour reproduction have enabled the writers to depict with great accuracy the damage inflicted on fodder and sugar beets, kohlrabi, and carrots by adverse physiological factors, including the deficiency of essential elements and over-fertilizing, as well as by fungal and virus diseases and insect pests. Specially important diseases are illustrated in various stages of development.

Newton (Margaret) & Peturson (B.). **Uromyces betae in Canada.**—Abs. in *Phytopathology*, xxxiii, 1, p. 10, 1943.

Beet rust (*Uromyces betae*) was first detected in Canada in 1935 on sugar beet plots in two localities in British Columbia [*R.A.M.*, xv, p. 481], viz., Saanichton, Vancouver Island, and Agassiz on the mainland, the distance between which is 95 miles (including 35 of water and a high mountain range). In both places the plots were sown with seed imported from Europe and bearing large numbers of uredo- and teleutospores. The disease has been present every year since its first appearance in the Saanichton district, where its severity reaches a maximum in the early spring and late autumn. Greenhouse experiments showed the rust to be very sensitive to high temperatures, the optimum for uredospore germination being from 10° to 22° and for rust development from 15° to 22° C., beyond which ordinarily susceptible varieties acquire a resistant reaction culminating at 26°. The summer temperatures in Alberta, Saskatchewan, and Manitoba are probably too high for the development of the disease.

Kotila (J. E.). **A new Sugar Beet leaf blight caused by a strain of Corticium solani.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 6–7, 1943.

Since 1938 a new form of foliar blight has been observed in commercial sugar beet-growing fields in Virginia and later in Michigan, Illinois, Wisconsin, and Minnesota, protracted spells of high humidity favouring the development and severity of the pathogen. The heart leaves are reduced to tip-burned stubs, while necrosis may involve one-third to one-half of the blade of older ones. The characters of the basidia, sterigmata, and basidiospores (8·0 by 12·9 to 4·8 by 8·0 μ) of the fungus produced on the dorsal leaf surface adjoining the infected tissue agree with those of *Corticium solani*, of which the strain under observation, however, is regarded as distinct from those previously reported as pathogenic to the same host [*R.A.M.*, xix, p. 59 *et passim*]. The inoculation of sugar beets with pure cultures of the fungus resulted in typical foliar symptoms and damping-off of seedlings, but no decay of half-grown roots. Basidiospore infection occurred in 60 per cent. of the beets exposed by placing them below leaves bearing the *Corticium* stage suspended on screens, whereas only one out of 58 controls in an adjacent compartment under comparable atmospheric conditions (90 to 100 per cent. relative humidity and a temperature of 75° to 80° F.) developed the symptoms, probably due to the accidental air dissemination of a basidiospore. Early field infections are believed to arise

from the soil-borne *Rhizoctonia* stage of the organism, and later ones from the basidiospores of *C. solani*.

REINKING (O. A.). **Distribution and relative importance of various fungi associated with Pea root-rot in commercial Pea-growing areas in New York.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* 264, 43 pp., 12 figs., 1942.

In New York State the organisms primarily responsible for root rot of peas are, in descending order of importance, *Fusarium solani* var. *martii* f. 2, *Aphanomyces euteiches*, *Pythium ultimum*, *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta pinodella*. These (and the disease they cause) occur in soils with P_H values ranging from 6·25 to 7·48; in a few cases they occur at P_H 5·4 and 5·5.

F. solani var. *martii* f. 2, *P. ultimum*, and *C. solani* were ascertained to be indigenous to certain virgin pea soils. The first two multiply in the soil with repeated pea plantings, and the severity of pea root rot would appear to depend on the progressive accumulation of destructive fungi.

The evidence indicated that *F. solani* var. *martii* f. 2 is always active, accounting year after year for most disease, while *Aphanomyces euteiches* may be comparatively unimportant in very dry weather.

Six years' field studies on the Station farm, where peas have been grown in rotation for 16 years, demonstrated that the chief root-rot fungi were not completely eliminated by a 3-, 4-, or 5-year rotation, but commercially profitable yields were secured in favourable growing seasons on properly fertilized fields in spite of the presence of the organisms.

Proof was obtained that strains of *F. solani* var. *martii* f. 2 and of *P. ultimum* exist that vary in their ability to cause pea seed decay in moist soils and root rot with fatal stunting.

One strain of the former from root rot of a California red kidney bean was highly pathogenic to peas and able to attack dry beans, which should be excluded from a rotation in fields where peas are planted.

The following recommendations are made. Peas should be planted as early as possible, cool soil being unfavourable to fungal growth. Crop rotation and the maintenance of a high fertility level are of the first importance. In New York State peas should be planted only in selected, well-prepared and -fertilized, well-drained soils not previously planted to this crop for many years.

SNYDER (W. C.). **Controlling Ascochyta blight of Pea.**—*Canning Age*, xxiii, 13, pp. 681–682, 684, 1 fig., 1942; xxiv, 2, pp. 96–97; 3, pp. 204–205, 1943.

This is a summary of the available information concerning pea blight (*Ascochyta pisi*, *A. pinodella*, and *Mycosphaerella pinodes*), which caused exceptionally heavy losses in 1941 and 1942 in the major pea-growing areas of the United States. The points discussed include the symptomatology of the disease, its development in relation to environmental conditions, the life-histories of the causal organisms, modes of perpetuation (mainly by the seed), and control (chiefly by cultural practices and frequent field inspections, since seed treatment, though useful as a precaution against surface contamination, is unavailing against internal infection). The blight pathogens have undoubtedly long been present in the western pea-seed producing areas of Idaho, Montana, Wyoming, Utah, Washington, and California, the writer having detected them in the heart of this region in 1930 and again found them present in 1941 in all the above-mentioned States except Wyoming and Utah, which were not visited.

THOMAS (H. R.). **Cercospora blight of Carrot.**—*Phytopathology*, xxxiii, 2, pp. 114–125, 2 figs., 1943.

The writer's studies on carrot blight at Santa Maria, California, were concerned

primarily with the physiology of the causal organism, *Cercospora carotae*, and with the host-pathogen relationship and epidemiology of the disease. Under natural conditions the fungus attacks both wild and cultivated carrots, 107 varieties and selections of the latter showing no appreciable degree of resistance to the blight in field tests, while *Daucus hispanicus*, *D. maritimus*, *D. pulcherrimus*, *D. maximus*, *D. gingidium*, and *D. pusillus* also contracted infection. The elongated primary lesions, sometimes surrounded by a diffuse chlorotic border, are usually situated along the edges of the leaflets, causing a lateral curling and expanding until their ultimate coalescence involves and destroys the whole leaflet. Under humid conditions the lower surface of the diseased area is apt to present a pale grey or silvery appearance due to the profusion of hyaline to faintly tinted, cylindrical, 1- to 6-septate conidia, 40 to 110 by 2 to 2·5 (average $95 \pm 13{\cdot}5$ by $2{\cdot}2 \pm 0{\cdot}1$) μ, borne on fasciculate conidiophores, 2 to 3 μ in diameter, which develop on the infected surfaces before the host tissue is killed. The entire petiole of older leaves may be covered by linear, blackish-grey lesions, also assuming a pale grey to silvery cast on the formation of conidia, and sometimes girdling and killing the leaf.

The germ-tubes enter the plant through the stomata, the advancing hyphae being at first intercellular but soon invading the intracellular regions. Sporulation may begin soon after the establishment of the fungus in the substomatal cavity, but is more often delayed until deeper penetration is effected. The pathogen occupies all the epidermal and parenchymatous tissue between the two surfaces of the lamina, the mesophyll frequently being completely permeated within five days.

C. carotae made the best growth on potato dextrose agar, but satisfactory development also occurred on pea, carrot root, and prune agars. Maximum rapidity was secured between 19° and 28° C., the heaviest production of conidia from 16° to 28°, and a hydrogen-ion concentration of P_H 5·5 to 7 favoured vigorous growth. The organism was shown by field experiments to persist in the soil from one crop to the next and to be disseminated by wind to a distance of up to 300 ft. Viable conidia were found on the seed from diseased seed umbels. The treatment of artificially contaminated seed with ethyl mercury phosphate (5 per cent. dust or 1 in 24,000 solution), ethyl mercury tartrate (1 per cent. dust or 1 in 24,000 solution), mercuric chloride (five minutes at 1 in 1,000), or spergon dust resulted in freedom from fungal growth on potato dextrose agar, but an adverse effect on germination was exerted by the first-named preparation in its dry form.

Significantly fewer leaf spots per sq. cm. (0·19) developed on plants deprived of calcium or nitrogen than on those receiving a full complement of nitrogen, phosphorus, and potassium (0·31) or on those deficient in potassium (0·26) or phosphorus (0·28). The spots attained their maximum length of 6·5 mm. on the complete-nutrient plants, were intermediate on those lacking potassium or phosphorus, and shortest on the calcium- and nitrogen-deficient series (2·7 and 2·3 mm., respectively). Conidia were most numerous on the lesions on the complete-nutrient plants and fewest on those lacking phosphorus, calcium, or nitrogen, the position in respect of potassium shortage being intermediate. In cultures of *C. carotae* on sterile leaf-juice extracts from the various series heavier growth was obtained on those from the complete, potassium-, and nitrogen-deficient plants than in those deprived of calcium or phosphorus.

Pierce (E. C.) & Stoddard (D. L.). **Some effects of sand and nutrient supply on a physiological leaf spot of Cantaloupe.**—*Phytopathology*, xxxiii, 2, pp. 162–164, 1943.

A severe leaf-spotting of cantaloupes grown in quartz sand with a constant supply of nutrient at the Maryland Agricultural Experiment Station was shown by tests on the White Seeded Pink Meat variety to be due to the use of too fine a grade of

sand. The trouble was corrected by the substitution for the fine material of a coarser grade, the ratio of air space in the latter as compared with the former being as 8 : 1. An application of 500 ml. nutrient once every 24 hours was superior to other methods of supplying nutrient.

GARINO-CANINA (E.). **The utilization of Grape leaves treated with copper preparations.**—*Ann. Chim. appl.*, xxx, pp. 231–232, 1940. [Italian. Abs. in *Chem. Abstr.*, xxxvii, 6, p. 1556, 1943.]

The ash of vine leaves treated [against downy mildew, *Plasmopara viticola*] with copper preparations was found to contain 2 to 3 per cent. of the mineral, corresponding approximately to 25 kg. copper sulphate per ha. This copper is recoverable by treatment of the ash with ammonium hydroxide or solutions containing citric or tartaric acid. As an alternative, sulphur and a small quantity of an ammonium salt or citric acid may be added to the ash and the resultant mixture applied to the vines.

STELLWAAG (F.). **Stand und Krisis der Schädlingsbekämpfung im Weinbau.** [The status and crisis of pest control in viticulture.]—*Z. PflKrankh.*, liii, 1–3, pp. 113–124, 1943.

Most of the items of phytopathological interest in the author's survey of the present critical position of pest and disease control in German vineyards have been noticed in this *Review* from other sources, but it may be of interest to mention that W. Maier's investigations on the etiology of chlorosis [*R.A.M.*, xxii, p. 144] showed the trouble to have extended over some 5,000 ha. during the past few years. In connexion with the control of *Plasmopara viticola* the writer ascertained in 1932 that the disbursements for wages and fungicides in the Palatinate ranged from RM. 318 to 500 per ha., these figures agreeing in substance with those recently cited by [H.] Zillig in an exposition of the economic importance of vine protection in Germany (1941). The latter authority computed that the annual (Greater) German consumption of sulphur, copper sulphate, and spraying lime amount to 1,875, 20,000 and 10,000 tons, respectively. The cultural factors contributing to the difficulties of combating vine diseases and pests are discussed.

HADORN (C.). **Vergleichende Versuche im Jahre 1942 über Kupfersparmöglichkeiten im Weinbau.** [Comparative experiments in the year 1942 on the possibilities of copper economy in viticulture.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 1, pp. 1–21, 1 diag., 5 graphs, 1943.

Thanks to the salvage of metal in Switzerland it was possible to set aside 400 tons of copper units for viticulture in 1942 [*R.A.M.*, xxi, p. 497], 40 per cent. of which, however, had to be utilized in the form of copper-Sandoz (red copper oxide with 50 per cent. metallic copper, the content of the latter in a 0·5 per cent. mixture being equivalent to that of 1 per cent. Bordeaux). This preparation should not be applied interchangeably with Bordeaux in the campaign against downy mildew (*Peronospora*) [*Plasmopara viticola*] but throughout the spraying period either by itself (0·5 per cent.) or with pomarsol (0·2 : 0·5 per cent.). Good to very good results were also obtained with pomarsol + Bordeaux mixture (0·5 : 0·2 per cent.) and 1·5 per cent. Bordeaux mixture, while 0·25 per cent. copper-Sandoz gave adequate control and some reduction of the incidence of infection was secured by treatment with 1 per cent. ramitol (an Italian product containing 8·2 per cent. metallic copper with a base of copper citrate + bentonite) and 1 per cent. cupramina, also of Italian manufacture, consisting of copper and ammonia neutralized by hydrated lime, with a metallic copper content of 8·1 per cent.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 2, pp. 98–104, 6 figs., 1943.

Potato leak or watery wound rot (*Pythium de Baryanum*) is not widely prevalent in Victoria, where it is mostly confined to soils rich in organic matter, but it causes serious loss in transit and storage, particularly when the potatoes have been dug in warm weather. Infection always occurs through mechanical injury or following sun scald. The chief means of control is a four- to six-year rotation, which can include pasture, oats, onions, maize, and peas. Infected potatoes should be collected and destroyed. In areas where the disease is prevalent digging should be carried out in cool weather or, at least, in the cool part of the day. If digging is carried out in warm weather infection is reduced if 'short runs' are lifted and 'picked up', so that the potatoes are not left on the hot soil for long periods. After 'picking up' the bags should be removed promptly to a cool place. Special care should be taken to avoid injury when bagging, and only sound tubers should be bagged. Loading hooks should not be used on the bags.

Tomato early blight (*Alternaria solani*) is favoured by moist conditions and moderately high temperatures. The fungus effects entry to the fruit through insect punctures, wounds, and growth cracks. Storage losses are sometimes very heavy, especially in early tomatoes, which are generally kept in ripening rooms on arrival from Western or South Australia. In the warm, humid conditions prevailing in the ripening rooms the almost inconspicuous lesions rapidly enlarge, and mould develops. Tomato seedlings should be treated with a 7 per cent. copper dust, and the same treatment can be applied in the field if necessary.

Raspberry mosaic was found in the Kalorama and Silvan districts of Victoria. Growers should carry out an inspection for the disease early in December. It would be inadvisable to do this earlier, as an obscure condition, apparently of physiological origin, has been observed in the Kalorama district, the early symptoms of which resemble mosaic. A mottle, much fainter than that due to mosaic, develops, but there is no leaf distortion. The mottling spreads, and the second phase of this disease is the appearance of a cadmium yellow colour between the veins; later the affected tissue dies. Mosaic plants should be promptly removed and burnt. Cultivation of the very susceptible Everbearing variety should cease. At present the virus appears to be confined to this variety, and fair yields are still obtained from it, but if an insect vector were accidentally introduced into Victoria, all the other varieties grown might become affected.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 3, pp. 149–154, 6 figs., 1943.

All varieties of French beans [*Phaseolus vulgaris*] grown in Victoria are susceptible to mosaic. Severe dwarfing and failure to produce seed are a very noticeable symptom in the Small White variety of Navy bean which has been widely sown in Victoria during the present season. Growers wishing to obtain clean seed should delay the sowing of seed crops until the arrival of warm weather, and should rogue their crops periodically throughout the growing season, beginning with the appearance of the first compound leaves, and repeating the operation every fortnight. The early roguings must be extremely thorough. A relatively small area isolated from other bean crops should be used. The evidence indicates that the disease is spreading.

Tomato bacterial canker [*Corynebacterium michiganense*: *R.A.M.*, xviii, p. 279; xxi, p. 353] can be controlled by selecting seed only from clean fields. As a further precaution, the seed should be extracted from the fruit by fermentation with the pulp without water for at least two days, and seed of unknown origin should be treated for 5 minutes with mercuric chloride ($\frac{1}{4}$ oz. in 5 gals. water). Finally the

seed should be washed in running water for 10 to 15 minutes. A field that has produced an infected crop should not be planted to tomatoes the following season.

Black spot or anthracnose (*Elsinoe ampelina*) is, locally, one of the commonest vine diseases. During pruning, badly diseased canes should be removed and burnt. During the dormant period the canes should be swabbed with a solution made up of 20 lb. sulphate of iron, 8 lb. commercial sulphuric acid, and 10 gals. water. At bud burst the canes should be sprayed with Bordeaux mixture (10–5–50), a 6–4–40 solution being used just before blooming and after fruit-setting. If the season favours infection, further applications should be made when the disease reappears.

Divisions of Plant Pathology and Seed Investigations.—*Rep. N.Y. St. agric. Exp. Sta., 1941–2*, pp. 52–60, 75–79, 1943.

In further work on apple scab [*Venturia inaequalis*] control in western New York [*R.A.M.*, xxi, p. 244] a wettable sulphur programme has replaced the lime-sulphur, which seriously reduced productiveness. Insoluble coppers were introduced to eliminate the risk of sulphur injury at high temperatures, and were also used with summer oil and nicotine. Improved methods were devised for testing commercial brands of these two groups of fungicides alone and in combination with insecticides.

It was found that on the whole wettable sulphurs with an average particle size of about 3 μ are most desirable. Lime (1–100) conspicuously increases the tenacity of most sulphurs of this group, and should be used when they are applied under unfavourable drying conditions. Orthex, useful for spraying in rain, impairs the fungicidal efficiency of sulphur when applied in cold water. Lime (1–100) tends to make the sulphur and oil sticker combination a valuable one, especially if a low concentration of sulphur is desired. Of the raw materials undergoing test, fermate [ibid., xxii, p. 213] shows the greatest possibilities, and will be particularly useful in the event of a copper shortage.

Under the conditions prevailing in the Hudson Valley no form of wettable sulphur, paste or dry, can be expected to give adequate protection against scab when used at less than 4 lb. of actual sulphur per 100 gals. of spray, and most of the dry forms should be used at 5 in 100. Fermate showed some indication of controlling scab, but was in no way as specific for *V. inaequalis* as it was for cedar rust [*Gymnosporangium juniperi-virginianae*]. A ground treatment of $\frac{1}{2}$ per cent. elgetol so reduced the carry-over of scab in a McIntosh orchard that five applications of lime-sulphur gave 95 per cent. clean fruit, though the same treatment on the same farm gave only 60 per cent. clean fruit without the ground treatment. Against cedar rust in the Hudson Valley fermate was effective in the field at a concentration of $\frac{1}{2}$ in 100, greenhouse tests indicating that an even lower concentration may be practical.

Copper materials used against cherry leaf spot [*Coccomyces hiemalis*: ibid., xxi, pp. 245, 442, 464] that previously had given the least copper injury or yellow leaf, during the period under review gave the most. The ill effect was plainly due to arsenical injury, confirming the view that some of the insoluble forms of copper act as arsenical correctives and that copper injury is greatest when temperatures are high. Plots sprayed with Bordeaux mixture continued to give small fruits. It would seem that any one of the four pre-harvest sprays can reduce yield. The lime in Bordeaux mixture (1$\frac{1}{2}$–6–100) should be reduced to 3–100 and should be eliminated from bordow in the second maggot spray. Fermate, which gave good control of cherry leaf spot, and kept the foliage on the trees later in the autumn than other treatments, was also found to be a good pre-harvest spray against brown rot [*Sclerotinia fructicola* and *S. laxa*]. The use of soluble cottonseed oil with the fermate appeared to be of value in preventing fruit crack.

In an attempt to discover a fungicide able to protect peach trees against infection

through normal wood, wounds, or arsenical injuries by *Valsa* fungi [*V. cincta* and *V. leucostoma*: ibid., xvi, p. 821], it was found that Bordeaux (1½–16–100) can be tolerated for one application at least, though insoluble copper materials were injurious. Zinc sulphate-lime (1½–8–100; 5–8–100 standard recommendation) was a better arsenical corrective than lime 16–100, an important item in the control of these fungi. Elgetol, even at 1 per cent., was ineffective against dormant cankers.

Spraying peaches during blossoming against brown rot [*S. fructicola*] is quite feasible, and is believed to be more suitable than spraying in the pink stage, though infection can occur during the latter.

In experimental plots a low dosage of Bordeaux mixture (not over ½ lb. of actual copper per 100 gals.) continued to give adequate control of vine black rot (*Guignardia bidwellii*), downy mildew (*Plasmopara viticola*), and powdery mildew (*Uncinula necator*). The use of the hooded boom for spraying grapes is a major advance in technique.

Further work on raspberry spur blight (*Didymella applanata*) control indicated that the application of 1 per cent. elgetol should be made as late as possible, though injury may result if the buds are out more than ½ in. Lime-sulphur (1–10) or 1 per cent. elgetol solution gave satisfactory control of raspberry anthracnose (*Plectodiscella veneta*); the spray should be deferred until the buds show at least ¼ in. of green.

Commercial control of the currant leaf spot diseases caused by *Mycosphaerella grossulariae* and *Pseudopeziza ribis* resulted when 70 per cent. of the leaves remained on the bushes until 1st October. Three years' investigations demonstrated that this can be accomplished by spraying when the fruit is half-grown and after it has been picked. Bordeaux mixture (3–3–100) gave excellent results, and left no objectionable residue on the fruit. Some insoluble copper compounds were good, but not better than Bordeaux mixture.

Three years' work showed that a schedule of two sprays controls gooseberry powdery mildew [*Sphaerotheca mors-uvae*] and the leaf spots *M. grossulariae* and *P. ribis*. The first, consisting of lime-sulphur (1–50) should be made immediately after blossoming, and the second, consisting of Bordeaux mixture (6–10–100), after the fruit has been harvested. No insoluble copper compound tested gave consistently such good results as lime-sulphur. In some seasons yellow cuprocide plus cottonseed oil gave as good control of mildew as did the lime-sulphur, but in dry seasons lime-sulphur gives much better control of mildew than does a copper fungicide. As lime-sulphur does not control the leaf spots, a copper fungicide must be used for the second application.

In spite of the dry season seed treatment of peas gave average yield increases of 200 to 470 lb. of shelled peas per acre. Spergon again gave good results on the Surprise, Wisconsin Early Sweet, Gradus, Alderman, and Green Admiral varieties. It also increased the yields of Alaska peas in one field by 300 lb. per acre in duplicate tests. These results were due to fungicidal efficiency combined with growth-stimulating properties.

In New York State the following organisms (in descending order of importance) are primarily responsible for diseases of peas: *Fusarium solani* var. *martii* f. 2, *Pythium ultimum*, *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta pinodella* [see above, p. 285]. The organisms and the diseases due to them occurred in soils with P_H ranging from 5·4 to 7·48. Six years' investigations of conditions in fields on the Station's canning crop farm at Geneva, where peas have been grown for 16 years, showed that the important root-rot organisms were not completely eliminated by a four- or five-year rotation. Commercial yields were obtained in favourable seasons on suitably fertilized fields in spite of the presence of the pathogens, indicating that their population had been reduced by the rotations to a point where

commercial yields became possible. The importance of a crop rotation and the proper maintenance of a high fertility level was indicated.

Treatment of Lima bean [*Phaseolus lunatus*] seed with spergon increased emergence by 5 to 10 per cent. and yields by 100 to 700 lb. of shelled beans per acre. New improved semesan jr. appeared in these tests to be safe and effective. Tetramethyl thiuramdisulphide gave distinct promise as a seed protectant in greenhouse tests, and did not injure Lima beans.

In spite of the dry season, treatment of maize (sweet corn) seed with new improved semesan jr. and spergon increased emergence by 2 to 10 per cent. and yields by 200 to 300 lb. of green corn [per acre] in commercial fields.

Field tests with commercial stock of cabbage resistant to yellows [*F. conglutinans*] proved the high quality and resistance of the varieties Jersey Queen, Wisconsin Golden Acre, Racine Market, Marion Market, Early Copenhagen Resistant, All Head Select, Wisconsin All Season, and Wisconsin Ballhead. Wisconsin Hollander and Wisconsin Hollander No. 8 showed reduced resistance in hot weather. The newer selections of Wisconsin All Season appeared to possess greater resistance than those of previous years.

Treatments of Lima bean seed (to improve stands and increase yield) with copper oxide (red and yellow), copper oxychloride sulphate, vasco 4, graphite, sanoseed, formacide, barbak, new improved semesan jr., spergon, and other materials showed that all the copper compounds and barbak C caused hardening of the seed coat and stunting in the early stages of growth, at all dosages tested. Semesan jr. and spergon were not injurious and were the only treatments that improved stand, but even these materials gave only erratic results, and seldom increased the yield of marketable beans, based on weight. In spraying and dusting tests satisfactory control of downy mildew [*Phytophthora phaseoli*: ibid., xxi, p. 478] was given by copper sprays (yellow cuprocide, copper oxychloride, copper oxychloride sulphate, tribasic copper sulphate, and Bordeaux mixture, 4–4–50 and 4–2–50) and copper dusts (copper-lime 20–80, tribasic copper sulphate, copper oxychloride, and cuprocide G.A.). The dusts were as effective as the sprays.

C. solani was more frequent in the pea seed of the 1941 crop than in 1938, 1939, or 1940, and caused severe injury in a few samples. *Sclerotinia sclerotiorum* was occasionally found on pea seeds. *A. pisi* and *M. pinodes* were present on 2 per cent. of the pea seed lots submitted for germination tests.

Chloranil (or spergon) gave moderate control of *Rhizopus nigricans* and *Penicillium* spp. on various seeds, flour, talc, or 'phosphate fumes' being used as diluent. Melon seeds are sensitive to this chemical, though pea, bean, and maize seed tolerate excessive dosages. An organic formaldehyde, U.S.R. No. 601, gave promising results in mould elimination from melon seeds, on which a mixture of 3 parts talc and 1 part No. 601 was effective and non-injurious. U.S.R. No. 604 was not highly fungicidal on levels safe for melon, maize, and pea seed.

Du Bay 1228 E, as dip or dust, was very effective against moulds of fleshy seeds. Du Bay 1205 FF or tetramethyl thiuramdisulphide did not consistently eliminate moulds; no phytotoxicity was observed, whatever the dosage. A dust, IN 870 A3 (fermate), gave slight control of moulds and bacteria, but was not comparable with new improved ceresan in this respect. Beta-chlorethoxyethyl hydroxide as 4 per cent. concentration in talc proved to be an excellent fungicide. Supplied by the American Cyanamid and Chemical Corporation, as 154–6B, it was effective also against grain smuts.

Several of the newer materials, used for seed treatments in the field, such as spergon, 1205 FF, U.S.R. No. 604, 154–6 B, and Du Bay 1228 E were as good as, or even better than, the standard treatments. Spergon and 1205 FF, when applied to sweet corn, were much better than semesan jr. or barbak D; they appeared also

to afford protection against insects. As these materials contain no heavy metals, their use in place of copper and mercuric compounds helps to conserve valuable war materials. The mercurials 154–6 B and 1228 E proved very effective against grain smuts, but when mercury was of paramount importance in a treatment, they were inferior to new improved ceresan.

On p. 29 of this report it is stated that fineness of particle is directly related to the adhesiveness of fungicides in spray residues. Soy-bean protein and vegetable or mineral oils are the best stickers. The use of a new type of duster, in which a little oil is vaporized on to the dust as it leaves the nozzle, greatly increased the deposition and retention of sulphur dusts.

Bortels (H.). **Meteorobiologische Reaktionen einiger Mikroorganismen.** [Meteorobiological reactions of some micro-organisms.]—*Zbl. Bakt.*, Abt. 2, cv, 17–19, pp. 305–325, 3 figs., 32 graphs, 1942.

The results of the writer's experiments with a number of micro-organisms demonstrated a clear connexion between the rate and completeness of their biological processes and the prevailing meteorological conditions, activity being depressed by cyclonic states and stimulated by anti-cyclones. Among the observations made were some dealing with the influence of the weather on the intensity of 'star' formation in crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.* xxi, p. 444], the number of zoospores produced by the potato blight fungus (*Phytophthora infestans*), and the swarming of various bacteria, including *Pseudomonas tabaci* and *P.* [*Xanthomonas*] *medicaginis* var. *phaseolicola*, the agents, respectively, of tobacco wildfire and grease spot of beans [*Phaseolus vulgaris*].

During the transition from cyclonic to anti-cyclonic conditions, 'stars' were formed more rapidly and by a larger number of individuals of *Bact. tumefaciens* than under the reverse conditions, which, in fact, entirely inhibited this mode of development during the period of 24 hours fixed for the tests.

Notwithstanding certain experimental discrepancies, it appears to be certain that zoospore production in *Phytophthora infestans* increases with rising barometric pressure and sinks to a minimum simultaneously with, or a day before, a fall presaging relatively cool and very rainy conditions. The optimum temperature for the liberation of the zoospores from the sporangia was shown to lie round about 13° C., probably fluctuating between 10° and below 15°.

The intensity of swarming of *X. tabaci* and *X. medicaginis* var. *phaseolicola* was reduced by the presence of clouds and enhanced by their absence.

Riker (A. J.). **Inoculations with bacteria causing plant disease.**—Pure Culture Study of Bacteria (formerly Continuation Service of the Manual of Methods), ix, 2, Leaflet x, pp. x_{41}–3–x_{41}–13, 1941.

This leaflet, one of a series compiled and edited by the Committee on Bacteriological Technic of the Society of American Bacteriologists, was prepared in collaboration with P. A. Ark, Charlotte Elliott, E. M. Hildebrand, and J. G. Leach. It is a second edition of one issued in 1938, which has been largely rewritten and is now brought up to date. It treats briefly of methods for studying the pathogenicity of bacteria in plants and for making certain related investigations. None of the directions are intended to apply to bacteria as a whole: the methods selected are to be regarded only as guides for the beginner, and are to be modified as the circumstances demand. The points covered include simple representative inoculation methods for the inoculation of soil or seed, for inoculation by spraying, through wounds, by insects, with brief reference also to methods for use with fungi, and with viruses, treatment with bacterial products, antibody production, strain variations, the action of pathogens together, use of exogenous cultures, relative

efficiency in technique, making records, and the interpretation of results. A bibliography of 23 titles is appended.

Humphries (E. C.). **Wilt of Cacao fruits (Theobroma cacao). I. An investigation into the causes. II. A preliminary survey of the carbohydrate metabolism with special reference to wilt susceptibility.**—*Ann. Bot., Lond.*, N.S., vii, 25, pp. 31–61, 11 graphs, 1943.

It is concluded, from a study conducted in Trinidad from 1939 to 1941 with mature budded and grafted cacao trees and young clonal material, that the disorder referred to as cacao fruit wilt and characterized by the presence of young withered fruits of various sizes on cacao trees, is a physiological trouble primarily due to nutrient and water deficiency. Wilting affected fruits of all sizes up to roughly 10 cm. in length and of all ages up to about 70 days and was particularly marked after the appearance of a heavy flush of new leaves. Beyond this critical size the fruits survived unless attacked by pathogenic organisms. The size at which the fruits wilted became progressively smaller as the season advanced, but increased again after the crop matured. Fruits on the thinner branches, farthest away from the ground, were more easily affected than those on the thicker ones. It was found that cacao fruit is susceptible to wilting during the first phase of its growth cycle, a period of about 75 days, at the end of which the development of the fruit reaches its maximum; the second phase, lasting approximately 95 days, is a period of active metabolism, during which fat, starch, and sucrose accumulate in the seed.

Ausemus (E. R.). **Breeding for disease resistance in Wheat, Oats, Barley and Flax.**—*Bot. Rev.*, ix, 4, pp. 207–260, 1943.

In this paper the author reviews, with numerous references to the relevant literature, the results so far obtained in different parts of the world in breeding varieties of wheat, oats, barley, and flax for resistance to the chief fungal diseases by which these crops are attacked. All the information given has been noticed from time to time in this *Review*. A bibliography of 269 titles is appended.

Craigie (J. H.). **Heterothallism in the rust fungi and its significance.**—*Trans. roy. Soc. Can.*, Ser. 3, Sect. V, xxxvi, pp. 19–39, 7 pl., 1942.

The author summarizes some outstanding contributions (the more recent of which have been noticed in this *Review*) to the understanding of heterothallism among the rusts and the significance of the phenomenon in relation to their propagation. The pycnospores of the heterothallic rusts, by diploidizing haploid infections, have been shown to fulfil a useful function in the spread of these organisms. Cytological studies have included the mode of ingress of the pycnospore nuclei into the mycelia of haploid infections and, in part at least, the subsequent course pursued by the nuclei. Crosses have been made between different races in several rusts, e.g., *Puccinia graminis tritici*, *P. triticina*, *P. coronata avenae*, *P. anomala*, and *Melampsora lini*, and new races produced from such unions. In the case of *P. graminis*, partial interfertility has been established in crosses between different varieties, and complete interfertility among crosses between different races within the same variety. Genetical studies have shown that, in general, pathogenic potentialities and uredospore colour are inherited according to Mendelian laws, and that abnormal features tend to appear as a sequel to inbreeding successive generations of some (but not all) races.

Many (probably all) heterothallic rusts comprise a larger or smaller number of physiologic races, differing mutually in one or more factors for pathogenicity. These factors, as well as those governing other characters, become separated in haploid infections of two opposite sexes, so that hybridization affords an

opportunity for their redistribution and recombination, while new features arising through mutation or in some other manner in one race are transmitted to others. Thus, heterothallism constitutes a means of promoting variation among the rusts and thereby providing them with better chances of survival in a changing environment.

A bibliography of 79 titles is appended.

GEDDES (W. F.) & LEVINE (M. N.). **The distribution of thiamin in the Wheat plant at successive stages of kernel development.**—*Cereal Chem.*, xix, 5, pp. 547–552, 1 graph, 1942.

A tabulated progress report is given of the writers' analyses of the distribution of thiamin in Thatcher and Ceres wheat plants at successive stages of kernel development, forming part of a three-year Work Projects Administration co-operative study with the University of Minnesota, initiated in 1940, on the effects of leaf and stem rusts (*Puccinia rubigo-vera tritici* [*P. triticina*] and *P. graminis tritici*) on the agronomic properties of spring wheat, the translocation of plant constituents into the developing kernel, and the industrial quality and chemical composition of the resultant grain. The problem has been approached from two angles, i.e., inhibitive, in which rust epidemics were induced in the early stages of plant growth and arrested at stated periods by sulphur dusting, and preventive, involving the exclusion of the disease by the same treatment until certain stages of plant development were reached, whereupon artificial inoculations were made. The leaf-rust experiments were carried out with Thatcher, which was sown on 25th April and 21st May, and the stem-rust trials with Ceres, planted on the latter date only.

The average incidence of *P. triticina* in the early- and late-sown lots of Thatcher was 11 and 16 per cent., respectively, and of *P. graminis* in Ceres 5 per cent. The thiamin content of the kernels of early-sown Thatcher reached a maximum of 77·4 per cent. on the final date of sampling (1st August), whereas in (*a*) the glumes and rachis and (*b*) stems and leaves, it was highest (15 and 60·3 per cent., respectively), on the first date (8th July), and fell to a minimum of 2 and 20·6 per cent., respectively, on the last. Similar relationships obtained in the late-sown Thatcher and Ceres plants. Pending the completion of assays of plants with varying degrees of severity of rust infection, it may be stated that *P. graminis*, in particular, markedly reduced the translocation of thiamin into the kernels.

REITZ (L. P.), JONES (E. T.), JOHNSTON (C. O.), & PAINTER (R. H.). **Agronomic tests of new resistant varieties and hybrids of hard red winter Wheat in the presence of stem rust and Hessian fly.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 216–229, 3 figs., 1 graph, 1943.

In 1940–1 a number of winter wheat varieties and strains were tested in nurseries under three sets of growing conditions, viz., (*a*) generally favourable at Manhattan, Kansas, (*b*) adverse, chiefly on account of stem rust (*Puccinia graminis tritici*) at Ramona, Kansas, and (*c*) in the presence of a large population of Hessian fly, *Phytophaga destructor* (Say) [*R.A.M.*, xx, p. 107], at Springfield, Missouri. The data thus secured on the reactions of the plants to stem and leaf rust [*P. triticina*] and to the fly are discussed and tabulated. The most promising results in respect of resistance to the rusts were obtained with certain Marquillo and Hope hybrids. It is concluded from the quantitative evidence of the trials that inherent resistance to, or tolerance of, the pathogens under observation may confer a considerable measure of protection on winter wheats in the central Great Plains.

ATKINS (I. M.). **Reaction of some varieties and strains of winter Wheat to artificial inoculation of loose smut.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 197–204, 1943.

From 1938 to 1941 about 140 winter wheat varieties and strains were inoculated under field conditions at Denton, Texas, with loose smut (*Ustilago tritici*), the annual

loss from which during the period 1931 to 1939 was estimated at 454,000 bush. or 1·8 per cent. of the crop, while the reductions in the more humid central and north-central sections of the State may amount to 5 or 10 per cent., thus assuming considerable economic importance on individual farms. Moore's vacuum spore suspension method [*R.A.M.*, xv, p. 567] was used, and preliminary tests showed that the heads should be inoculated at the early to mid-anthesis stage of growth, any time of day being suitable, regardless of the humidity of the outside air.

None of the commercial hard red winter wheats proved to be resistant, but Pawnee, a new variety now ready for distribution by the Nebraska Agricultural Experiment Station, remained completely free from infection, like its Kawvale parent. A number of Hope × Kawvale selections (hard red) and Hope × Mediterranean (soft red) were also resistant and are likely to be of particular value in view of their simultaneous freedom from leaf and stem rusts [*Puccinia triticina* and *P. graminis*]. Other varieties maintaining a resistant reaction throughout the trials were Forward, Purdue No. 4, Leap, Zimmerman, Purplestraw, Early Premium, and Minhardt (all soft red).

Clark (J. A.). **Registration of improved Wheat varieties, XV.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 245–248, 1943.

Two wheat varieties were approved for registration in 1942, namely, Pawnee Reg. No. 330, and Comanche Reg. No. 331, both of the hard red winter type. Pawnee is moderately resistant to bunt [*Tilletia caries* and *T. foetida*], highly so to loose smut [*Ustilago tritici*: see preceding abstract], and either slightly resistant to, or able to escape severe damage from, stem rust [*Puccinia graminis*].

Comanche is highly resistant to many important races of bunt (average infection from 1937 to 1941, 1·5 per cent. compared with 71·4 and 38·1 for Chiefkan and Tenmarq, respectively), fairly so to leaf rust [*P. triticina*], and more tolerant of *P. graminis* than other varieties grown in the central and southern Great Plains.

Rodenhiser (H. A.) & Taylor (J. W.). **The effect of photoperiodism on the development of bunt in two spring Wheats.**—*Phytopathology*, xxxiii, 3, pp. 240–244, 1943.

The spring wheat varieties Canus and Ulka, inoculated with races L–1, L–2, and L–4 of *Tilletia levis* [*T. foetida*] and T–1, T–4, T–9, T–10, and T–12 of *T. tritici* [*T. caries*], were grown under natural and continuous-light conditions in the greenhouse at Arlington Farm, Virginia. In the former series of tests Canus was resistant to all races, while in the latter a marked breakdown in its resistance to the three races of *T. foetida* and to T–4 of *T. caries* was observed. Ulka was completely susceptible to all races but one (T–5) [*R.A.M.*, xxi, p. 329], to which its resistance was lowered by the protracted light treatment.

The maximum incidence of bunt occurred in plants growing at an extremely rapid rate, and it is suggested that the development of the pathogens is favoured by certain nutritional changes in the host induced by its prolonged exposure to light.

Angell (H. R.). **The effects of addition of lime and depletion of soil nutrients on take-all of Wheat.**—*J. Coun. sci. industr. Res., Aust.*, xvi, 1, pp. 18–27, 1943.

To ascertain whether the salts and exchangeable bases in soils influence the incidence of take-all (*O*[*phiobolus*] *graminis*) an open-air experiment was carried out in 1938 in which (*a*) 4 kg. hydrated lime, (*b*) 4 kg. ground limestone, (*c*) 0·5 kg. calcium sulphate, (*d*) 1·5 kg. ground magnesite, (*e*) 6·6 gm. potassium carbonate, and (*f*) 116 gm. sodium chloride were added to 5-gal. drums of soil, in which, subsequently, Nahama wheat was sown. Each treatment was applied to six drums. In three drums of each series dead mycelium of the fungus was placed among the

wheat seed, and in three others viable inoculum was used. In 1939 wheat was again sown, and the previous year's procedure followed. In 1940 no inoculum was added. When the seedlings were well established, all but six per drum were discarded. The plants were harvested at maturity, air-dried, weighed, the tillers counted, and the condition of the roots, the average grain weight, and the grade of the grain from each head estimated. In 1941 the procedure of 1940 was again followed.

The results in 1938 were as follows. The seedlings were not obviously affected by inoculation with *O. graminis*. As was observed in other (unpublished) experiments in 1939 and 1940, the seedlings grew best in soil to which potassium carbonate had been freshly added, maintaining their lead until brairding, when the initial advantage disappeared. Symptoms resembling mild toxicity then developed. Typical take-all symptoms subsequently showed up on 18 out of 32 plants, the more nearly normal ears bearing numerous aborted spikelets towards the tips, i.e., showing the condition known as 'tipped ears'. No difference was observed between the behaviour of the plants growing in the drums to which potassium carbonate only was added and that of those in the drums to which potassium carbonate and *O. graminis* were added. Of 31 plants in the latter, 13 appeared to be healthy, while the remainder failed to develop beyond the host stage. The greatest difference between the inoculated and uninoculated plants occurred in the magnesium carbonate series, where, among the former 8 out of 34 heads emerged from the host, as compared with 22 out of 30 in the latter. In the calcium sulphate series, in the uninoculated drums 11 plants died in the host stage, while in the inoculated ones all the plants remained healthy.

In 1939 the dry weight of the plants grown in soil to which hydrated lime, alone or with other bases, was added, was three times that of the plants grown in the control soil. All the plants in the inoculated drums were very severely affected by *O. graminis*, differences in soil treatment exerting no apparent influence on infection.

In 1940 the plants in all the drums to which hydrated lime was added, alone or together with compounds of magnesium, potassium, or sodium, made much better growth than those in drums that received ground limestone, calcium sulphate, ground magnesite, potassium carbonate, or sodium chloride. On 29th October, 60 plants were taken for examination. The worst plant was chosen from each of three drums in each series. Lesions were found on the roots of 22, and *O. graminis* was isolated from seven, three of the seven plants coming from drums into which the fungus had not been experimentally introduced.

At heading, sudden wilting and death from take-all occurred only in two of the drums to which potassium carbonate was added, and in four of the six control drums. As in the previous year, there were marked differences between the effects of the soil treatments, but only hydrated lime caused significant effects on all measures of take-all symptoms, viz., total weight, mean root rating, mean grain weight, and mean percentage of plants in a pot with half or more than half the number of ears containing grain averaging 0·045 g. in weight. According to all measures, there were highly significant differences between drums inoculated in 1938 and 1939 and the uninoculated ones, the plants in the former being superior and less affected by disease. This unexpected result was also obtained in three other (unpublished) experiments. In 1941, the results resembled those obtained in 1940. The only important effects were again observed in the drums to which hydrated lime was added.

Thus, in three consecutive years, the effects of *O. graminis* on wheat grown in soil containing an excess of hydrated lime were consistently much less noticeable than they were in the same soil without lime. This effect would appear to be due to increased availability of some nutrient, the vigorous plant growth so induced

adding to the resistance of the plants. The supply of nutrients made available year after year is reflected in the relatively improved growth and yield of the later years. Further evidence in support of this view is supplied by the striking difference in growth between the plants in the inoculated and uninoculated drums during the second year. The development of the plants and the amount of take-all injury were almost the reverse in the second year of what they were in the first. The plants in the drums inoculated during the previous year were thriving and healthy, while those in the uninoculated ones were extensively diseased. The influence of nutrient availability on infection by *O. graminis* needs further critical study.

Russell (R. C.). **The relative importance, from the pathological standpoint, of two types of smudge on Wheat kernels.**—*Sci. Agric.*, xxiii, 6, pp. 365–375, 1 pl., 1943.

Two types of smudge are present on wheat kernels in Saskatchewan, referred to as 'mild' and 'severe'. In the former the discoloration centres on the embryo and does not appear on the ventral side, while in the latter it is darker and does not extend so far from the tip of the kernel, where it appears on both the ventral and dorsal sides. Kernels showing the mild type are well filled, while those affected with the severe type are usually shrunken and may be bleached. In the samples examined the mild type was about ten times as common as the severe. Tests showed that apparently clean seeds and those with the mild type of smudge carried little infection by *Helminthosporium sativum*, while seeds with severe smudge produced *H. sativum* on a high percentage of the kernels.

In a greenhouse test Apex wheat seed, clean, with mild smudge, and with severe smudge gave, respectively, 93·4, 94·6, and 82 per cent. total emergence, and 5·4, 3·6, and 16 per cent. pre-emergence blight, while the dry weights of the seedlings were 1·224, 1·344, and 1·032 gm.; the corresponding figures for Regent seed were 92, 87·4, and 74·6 per cent. total emergence, 4·4, 7·6, and 16·4 per cent. pre-emergence blight, and 1·026, 1·036, and 0·822 gm. dry weight.

Apex seed with mild smudge, untreated and treated with ceresan gave, under greenhouse conditions, 92 and 97·3 per cent. total emergence, respectively, and 5·7 and 2·3 per cent. pre-emergence blight, the corresponding figures for severely smudged seed, being 65·3 and 99 per cent. and 22 and 0·3 per cent. No smudge appeared in the grain of plants grown in the greenhouse from slightly or severely smudged seed.

In a field test carried out in 1942, three samples each of clean, mildly, and severely, smudged seed, averaged, respectively, 92·3, 85·6, and 64·9 per cent. emergence, and 223·9, 221·9, and 173·2 gm. yield of grain.

These studies are considered to have a direct, practical application to the testing of seed wheat. The two types of smudge can be recognized by visual examination. The mild type is of only slight importance, while the presence of the severe type is a reliable indication of infection by *H. sativum*, and grain showing appreciable amounts of it should not be used for seed unless treated with a suitable fungicide, such as ceresan.

Gorter (G. J. M. A.). **Disinfecting winter cereal seed against smut and other diseases.**—*Fmg S. Afr.*, xviii, 204, pp. 187–188, 1943.

The author recommends agrosan G or ceresan as the most suitable materials for the disinfection of cereal seed-grain against fungal diseases in general. Brief directions are given for their use. The paper concludes with instructions for applying the hot-water method of treating wheat and barley seed against loose smut [*Ustilago tritici* and *U. nuda*, respectively]. Treated seed should be planted in a small plot so situated that spores from infected crops cannot be blown on to

it; the seed collected from this plot should be quite clean, and can be used for planting the following season.

TAPKE (V. F.). **Occurrence, identification, and species validity of the Barley loose smuts, Ustilago nuda, U. nigra and U. medians.**—*Phytopathology*, xxxiii, 3, pp. 194–209, 4 figs., 1943.

In a study of the different kinds of barley loose smut 500 specimens collected from 33 States of the American Union were uniformly germinated on 2 per cent. potato dextrose agar at 20° C. Six of these were heterogeneous types, while of the remainder, all of which were characterized by the loose type of smutted head and echinulate spores, 192 produced the mycelial germination of *Ustilago nuda*, 209 the sporidial germination of *U. nigra* [*R.A.M.*, xx, p. 296], and 93 a mixture of the two forms, those of the last-named also conforming in other respects to the description of *U. medians* [ibid., xviii, p. 388]. On further investigation, however, the representatives of this group were found to be merely combinations of *U. nuda* and *U. nigra*, there being apparently no separate species agreeing with the diagnosis of *U. medians* either in the United States or elsewhere.

When spores of *U. nuda* and *U. nigra* are uniformly germinated on 2 per cent. potato dextrose agar or other standard media, the former species consistently produced only hyphae and the latter exclusively promycelia and sporidia. By this means it can thus be rapidly and reliably ascertained whether (1) the pathogen is *U. nuda*, *U. nigra*, or a mixture of the two, and (2) the mode of seed treatment requisite to ensure control. Comparative chlamydospore germination tests of *U. nigra*, *U. avenae*, *U. levis* [*U. kolleri*], and *U. hordei* on ten different media at 20° C., and on 2 per cent. potato dextrose agar at a range of 5° to 40° yielded conclusive evidence that the first-named is a true sporidia-producing smut comparable to the other three.

Specific incidence in the present study denotes that the distribution of *U. nigra* in the United States has become as extensive as that of *U. nuda*. Half the computed annual 2,000,000 bush. loss attributed to barley loose smut may therefore be prevented by simple and inexpensive seed treatments [ibid., xv, p. 211].

With the exception of occasional hybrid types, such as occur also in the wheat and oats smuts, loose smut of barley in the United States may, on the basis of these investigations, be referred either to *U. nuda* or *U. nigra* which are readily differentiable, e.g., by the spore germination test. *U. nigra* is a valid species, an amplified diagnosis of which is given. *U. medians*, on the contrary, appears to have been erroneously based by Biedenkopf (*Z. PflKrankh.*, iv, pp. 321–322, 1894) on a mixture of two distinct smuts, and the binomial is therefore rejected.

IMMER (F. R.), CHRISTENSEN (J. J.), & LOEGERING (W. Q.). **Reaction of strains and varieties of Barley to many physiologic races of stem rust.**—*Phytopathology*, xxxiii, 3, pp. 253–254, 1943.

Two barley varieties, Peatland C.I. 452 and Chevron C.I. 1111, and 20 hybrids, normally resistant to stem rust in the field, and two varieties ordinarily susceptible to the disease, Barbless C.I. 5105 and Minnesota 462, were tested at the Minnesota Agricultural Experiment Station in the seedling stage for their reactions to 19 physiologic races of *Puccinia graminis tritici* and one collection of *P. g. secalis*.

The varieties and hybrids that were resistant in the field showed a similar response as seedlings to all the races of *P. g. tritici* except 29, as well as to *P. g. secalis*, while the two susceptible varieties reacted comparably to all the races of *P. g. tritici* but proved resistant to *P. g. secalis*. Race 29 attacked all the varieties and strains in the seedling stage, and six tested at maturity were also susceptible.

It is apparent from these data that the seedling reaction to rust, being of a

physiological nature, is similar at all stages of growth, and therefore affords a reliable means for the early elimination of susceptible lines.

WEIMER (J. L.). **Anthracnose of Lupines.**—*Phytopathology*, xxxiii, 3, pp. 249–252, 1 fig., 1943.

The fungus isolated on oats agar from stunted, malformed, stem-girdled, and cankered lupin (*Lupinus angustifolius*) seedlings at Quincy, Florida, in March 1939, was compared with a culture of *Glomerella cingulata* from apple and identified with that organism. The plants are attacked under conditions of high humidity, the young leaflets, petioles, stems, and cotyledons being susceptible. Infection may also occur on the underground portion of the hypocotyl, but the main stem is seldom invaded, except at the apex or through the cotyledons or branches. Inoculation experiments on *L. albus* leaves resulted in severe injury, but *L. luteus* remained free from infection in the one test in which it was included. This is stated to be the first record of *G. cingulata* on lupins in the United States.

STANTON (T. R.). **Registration of varieties and strains of Oats, XII.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 242–244, 1943.

Since the publication of the last report on the registration of improved varieties of oats [*R.A.M.*, xxi, p. 330], two further varieties have been submitted and approved, namely De Soto [ibid., xxii, p. 94] (mid-season yellow), resistant to crown rust [*Puccinia coronata*], smut [*Ustilago avenae* and *U. kolleri*], and cold, and Bridger, which is derived from a cross between Markton and Victory and combines the superior agronomic qualities of the latter with the smut resistance of the former parent.

BREMER (H.). **An American Oat disease found in Western Anatolia.**—*Phytopathology*, xxxiii, 2, pp. 165–167, 2 figs., 1943.

The fungus isolated from the ill-defined, oblong, whitish to yellowish, red-bordered spots on the leaves of autumn-sown oats at the Bornova Plant Protection Station, Western Anatolia, Turkey, in March, 1938, was identified on the basis of its morphological, cultural, and pathogenic characters, as *Pseudodiscosia avenae*, hitherto recorded only from Oregon and Washington [*R.A.M.*, xix, p. 74]. The bi-, rarely tri-septate, hyaline, fusiform, slightly curved conidia of the Turkish fungus measured (with cilia) 23 to 45 by 3 to 4·5 (average 34·2 by 3·6) μ, the length without cilia being 15 to 27 (20·4) μ. A single cilium occurred at each end, one long and thick, the other short and slender. Very slow growth was made on carrot and potato dextrose agars and carrot slices. As in the United States, the leaf spot is correlated in Turkey with the cool, damp weather of early spring, disappearing after the beginning of April. It was again observed at Bornova in 1939 and 1940, but caused little damage. A wild grass, possibly *Avena sterilis*, on a mountain slope near Kemelpasa, some 35 km. from Bornova, was found to harbour a fungus apparently identical with *P. avenae*, having conidia (including cilia) measuring 24 to 39 by 4 to 5 (average 33·3 by 4·25) μ, the length without cilia being 18 to 23 (19·9) μ. It seems probable, therefore, either that the fungus is a native of Turkey which was accidentally introduced into the States, or else that its geographical range is much wider than is known on the basis of the available information.

Value of seed dressing.—*Fertil. Feed St. J.*, xxix, 5, p. 106, 1943.

In recent trials in Berkshire, Yielder oats seed-grain treated against leaf stripe [*Helminthosporium avenae*: *R.A.M.*, xxii, p. 128] with an organo-mercurial dressing yielded (on an average of three tests) 31·4 cwt. per acre compared with 28·4 cwt. for the controls. Even in a dry season the disease may attain epidemic proportions in the ripening crop, thereby endangering the health of any stands grown from

home-saved seed. An important result of these experiments was the evidence obtained concerning the heavy losses due to 'pre-emergence blight', which is the real cause of troubles commonly assigned to other factors. Severely blighted seedlings are swollen, contorted, and without sufficient vigour to emerge from the soil, while those which succeed in doing so are liable to infect the entire crop, especially under humid conditions. The wisdom of the cheap and simple precaution of applying an organo-mercurial preparation (likewise effective against barley leaf stripe [*H. gramineum*]) to the seed before sowing is thus apparent.

ZADE (A.). **En enkel snabbmetod för prövning av betningsmedlens verkan mot Havreflygsot, Ustilago avenae (Pers.) Jens.** [A simple and rapid method of testing the effect of fungicides on loose smut of Oats, *Ustilago avenae* (Pers.) Jens.]—*Nord. JordbrForskn.*, xxii, 7–8, pp. 244–255, 1940 (issued 1941). [German summary.]

A reliable estimate of the toxicity of fungicides to loose smut of oats (*Ustilago avenae*) can only be made on the basis of seed-grain with a minimum of 20 per cent. infection, an incidence ordinarily to be secured exclusively by means of inoculation, for which purpose the evacuation method [*R.A.M.*, xii, p. 431] is employed. The fungicides are tested by a procedure which has been found to be more rapid and convenient than the so-called 'Leipzig method' [ibid., x, p. 92]. The preparations are applied according to the prescribed directions, 50 seeds sufficing for each sample; however, since the treatment of such small quantities presents technical difficulties, seed-grain of another colour (black if the lot to be tested is pale) is added as a makeweight and discarded on completion of the steeping. The treated seeds are germinated in the ordinary way on moist blotting paper (saturated to 70 per cent. of its water-holding capacity). After 18 to 24 hours five seeds are removed from each batch, dehulled, and deposited on a slide after a thorough shaking in water. If the spores adhering to the caryopses are shown by microscopic examination to have germinated, the particular preparation under observation has evidently failed to penetrate the glumes, this being the critical factor in the matter of evaluation. On the other hand, the fungicides that have prevented spore germination may be regarded as effective for the object in view. After three or four days have elapsed the loss of viability may be safely presumed.

The results of laboratory tests by this method, which were confirmed by three years' field trials, show that the most uniformly toxic of the various treatments was immersion in mercuric chloride-formalin. Thus, in 1936, 1937, and 1938, the incidence of infection in the Svalövs Goldregen variety was reduced from 89·5, 84, and 65·9 to 0·2, 0·9, and 0·8 per cent., respectively, the corresponding figures for Orion being from 59, 69, and 59 to 0·2, 0·4, and 0·1, respectively. Immersion in formalin alone also gave very good results, the amount of smut in Goldregen treated with this fungicide during the three experimental years being 0·4, 1·3, and 1·8, respectively, and in Orion 0·3, 1, and 1·1, respectively, while the corresponding figures for germisan nassbeize were 0·8, 2, and 2·6, respectively, in Goldregen and 0·5, 2, and 4, respectively, in Orion. Dusting with ceresan only reduced infection in Goldregen to 4·9, 6·6, and 5·0 per cent., respectively, in 1936, 1937, and 1938, the corresponding figures for Orion being 4·0, 8·3, and 7·7, respectively.

A close parallel was observed between *U. avenae* and *Helminthosporium gramineum* in respect of their reactions to the various fungicides, depth of penetration clearly being the operative factor in either case.

MUKERJI (B.) & DEY (N. K.). **Assay of Indian ergot.**—*Curr. Sci.*, xii, 3, pp. 87–88, 1943.

Particulars are given of the botanical, chemical, and pharmacological assays of an ergot [? *Claviceps purpurea*] specimen cultivated on K. M. Thomas's rye plots

in the Nilgiri Hills by Hynes's method [*R.A.M.*, xxi, p. 135] at the Biochemical Standardization Laboratory of the Government of India, Calcutta. A. B. Bose, who was responsible for the botanical study of the specimen [ibid., xxii, p. 166], found that the average length of the sclerotia was 2 to 3 cm., with a minimum of 1 cm., their diameter being 4 to 5 mm. Some of these organs are cylindrical, with a thick base and subacuminate tip, while others are conspicuously curved; the yellowish core is surrounded by a dark-coloured hard exterior, which was shown by transverse sections to consist of small, dark cells, turning brownish-red on contact with sulphuric acid, the inner portion being constituted by subhyaline, densely aggregated, minute, oval or rounded cells. The length of the subcylindrical, slightly curved, longitudinally furcate sclerotia of material of *C. purpurea* imported from Europe, was determined by I. B. Bose as 1 to 3 cm.; their pinkish cores are surrounded by a dark brown exterior. Transverse sections revealed an appearance similar to that of the Indian sample.

The water-soluble and water-insoluble alkaloid contents of the Indian specimen, calculated as ergometrine and ergotoxin-ergotamine, respectively [ibid., xv, pp. 154, 720], were estimated (with the assistance of N. K. Dutt and B. Chowdhury) as 0·0237 and 0·1169 per cent., respectively. The ergot is therefore considered to be of good quality and compares favourably with many batches of imported ergot.

Plante (Enid C.) & Sutherland (K. L.). **Separation of ergot from Rye Corn.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 1, p. 28, 1943.

In Australia crops of rye corn containing 4 per cent. ergot [*Claviceps purpurea*] are being grown, and the problem is to remove the 96 per cent. of grain so that the final product does not contain more than 2 per cent. organic impurity. Density separations having proved unsatisfactory, the authors have attempted separation by using the surface properties of the two grains. An emulsion of purified paraffin oil, the droplets of which adhere to and spread over the waxy, hydrophobic rye surface, but do not adhere to the hydrophilic ergot surface, is added to the grain-ergot mixture. This oiled grain can be efficiently separated in a flotation cell, which should be of the pneumatic type to provide gentle agitation and good air dispersion. This produces an ergot product containing 1 per cent. or less of impurity with 95 per cent. or better recovery. The cost of separation is estimated at 3*d.* per lb. of ergot.

Niccolini (P.). **Über einen hypotensorischen Wirkstoff von Ustilago maydis.** [On a hypotensory active principle of *Ustilago maydis*.]—*Arch. ital. Sci. farmacol.*, xi, pp. 137–152, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 9, p. 965, 1943.]

At the Pharmacological Institute of the University of Sienna the author extracted from dried maize smut (*Ustilago maydis*) [*U. zeae*] balls, with distilled water containing 0·1 per cent. glacial acetic acid and 0·5 per cent. chloroform, a substance presenting several analogies with acetylcholin and exciting a marked reduction in the blood pressure of experimental animals (rabbits) by way of the parasympathetic nerve endings.

Margolin (A. S.). **The carbohydrate requirements of Diplodia macrospora.**—*Proc. W. Va Acad. Sci.*, xiv, pp. 56–59, 1940. [Received April, 1943.]

Diplodia macrospora [a pathogen of maize] has been reported as incapable of growth on dextrose but able to develop satisfactorily on sucrose [*R.A.M.*, xxi, p. 330]. In the writer's experiments, however, the fungus grew equally well on a synthetic medium containing dextrose, sucrose, or maltose at the rate of 20 gm. per l., provided the essential auxithal, biotin or an analogous substance, was added to the substratum at a concentration of 0·1 gm. per l. In the absence of the growth substance there was little or no growth on any of the sugars. The vigorous

development of *D. macrospora* on brown sugar is attributed to the presence of an auxithal as a contaminant, since purification of the sugar with norit (activated charcoal) resulted in a significant decrease in its capacity to support growth, which was restored by the addition of biotin to the medium.

Marchionatto (J. B.). **El 'moho' del Maiz.** [The 'mould' of Maize.]—Reprinted from *J. agron., B. Aires, 1941*, 8 pp., 3 col. pl., 4 figs., 1942. [English summary.]

Aspergillus flavus was found to be the predominant mould affecting stored maize in the Argentine [*R.A.M.*, xxi, p. 413], other fungi present being *Rhizopus nigricans* [*R. stolonifer*], *Fusarium moniliforme* [*Gibberella fujikuroi*], *Aspergillus herbariorum* [*A. glaucus*], *A. fumigatus*, *Penicillium viridicatum*, *P. olivinoviride*, and *Diplodia zeae*. *A. flavus* specifically attacked the albumin and under laboratory conditions its development was suppressed by dusting the seed-grain with 2 per cent. crystallized silex.

Porter (C. L.). **Fungus development as affected by carbon and nitrogen sources.**—Abs. in *Proc. Ind. Acad. Sci.*, l, p. 57, 1940.

Among other fungi *Diplodia zeae* was grown on a basic medium consisting of magnesium sulphate, ammonium nitrate, dihydrogen potassium phosphate, and a source of carbon, the substratum being sterilized in a water bath at 68° C. on three consecutive days. The best sources of carbon were dextrin and inulin, while urea, nucleic acid, and cystine gave satisfactory supplies of nitrogen.

Bain (D. C.) & Edgerton (C. W.). **The zonate leaf spot, a new disease of Sorghum.**—*Phytopathology*, xxxiii, 3, pp. 220–226, 3 figs., 1943.

Technical descriptions [but no Latin diagnoses] are given of *Gloeocercospora* n.g. and its type species, *G. sorghi* n. sp., the agent of a widely distributed leaf spot of sorghum, Johnson grass (*Sorghum halepense*), and Sudan grass in southern Louisiana, and observed also on the C[anal] P[oint] sugar-cane variety and maize. The disease was at first confused with that caused by *Titaeospora andropogonis* [*R.A.M.*, xxi, p. 286] from which *G. sorghi* differs, however, in its unbranched conidia, which are hyaline (salmon-pink in the mass), pluriseptate, elongate to filiform, 20 to 195 by 1·4 to 3·2 (average 82·5 by 2·4) μ, and borne in a slimy, pink matrix on hyaline, septate, simple or branched conidiophores, 5 to 10 μ in length. Black, lenticular to spherical, sclerotia, 0·1 to 0·2 mm. in diameter, occur in profusion in the necrotic host tissues. The salmon-pink sporodochia, which are situated on the leaf surface between the guard cells and above the stomatal apertures, arise on more or less well-defined stalks from hyaline, septate, branching hyphae emerging from the stomata.

The colour of the lesions produced by *G. sorghi* varies according to their size, usually being light brown with a light to dark red margin in the smaller spots, while in the larger ones dark and pale zones alternate. The infected areas, which are found along the margins or towards the midrib, may coalesce into semicircular or irregular blotches, sometimes covering the entire leaf.

Specimens of the pathogen on *S. halepense* and sorghum have been received from Mississippi, on Sudan grass from Virginia, and on sorghum from Florida, while the fungus attacking *Agrostis* seedlings in Pennsylvania is also apparently the same.

Melchers (L. E.) & Hansing (E. D.). **The effect of Sorghum kernel smuts on the development of the host.**—*J. agric. Res.*, lxvi, 4, pp. 145–165, 7 figs., 1943.

In investigations conducted from 1929 for seven years at Manhattan, Kansas, the effect of the kernel smuts, *Sphacelotheca sorghi* and *S. cruenta* [*R.A.M.*, xx, p. 160], on the development of the host was studied on 25 varieties, selections, and hybrids of sorghum. It was found that host varieties reacted differently to the two smuts, but in general they were more strongly affected by *S. cruenta* than by

S. sorghi. Thus, in the *S. sorghi* series, the average reduction in the height of the plant was 2 per cent., in the diameter of the stalk 18 per cent., and in the leaf width of diseased plants 16 per cent. as compared with normal plants, while the corresponding reductions in the *S. cruenta* series, races 1 and 2, were 19 and 18 per cent., 38 and 27 per cent., and 33 and 23 per cent., respectively. The reductions effected by both smuts are considered of economic importance since they lead to reduced tonnage of grain and forage.

The reduced height of infected plants was found to be due partly to shortened internodes, but mainly to a reduced number of internodes. Plants attacked by *S. cruenta* had fewer nodes (in several cases only half as many as healthy plants) than those attacked by *S. sorghi*. The following explanation is advanced for this reduction: the invasion of the apical meristematic tissue of the plant by the smut fungi affects the metabolism of the plant, possibly by means of a chemical stimulus, in such a way that it forms fewer nodes prior to the differentiation of the panicle than does a normal plant; consequently, the infected plant heads earlier and is thus dwarfed primarily owing to a reduced number of internodes. The extent of node reduction was found to vary in different varieties or strains of the host, as also the response in the same variety or strain of the host varied with different races of the two smuts.

Plants attacked by *S. cruenta* grew more rapidly, heading from a few days to about a fortnight earlier than normal plants, whereas plants attacked by *S. sorghi* headed approximately at the same time as healthy ones. Plants of all 25 varieties tested had an average of 1·4 tillers over the normal, when attacked by *S. cruenta* race 1 and 0·6 when attacked by race 2; those attacked by *S. sorghi* had 0·5 tillers over the normal. This tendency of smutted plants to tiller excessively was very pronounced in certain varieties. Some varieties of sorghum infected with *S. cruenta* produced proliferation of glumes, very striking in the field because of the brush-like appearance and abnormally dark green colour. Infection by *S. sorghi* had no such effect. Considerable variation was observed, in limited experiments, in the size and shape of sori according to the species and race of smut and the variety of sorghum infected. It appeared that kafir × feterita K.B. 2686 when infected with *S. cruenta* race 2 had longer and more curved sori than when attacked by race 1 of this smut or by *S. sorghi*. Infection with either smut led to a partial or complete lack of awn development in the milo group of sorghum and their hybrids.

Sinclair (W. B.) & Lindgren (D. L.). **Ridges and sectors induced in the rind of Citrus fruits by fumigation with hydrocyanic acid.**—*Plant Physiol.*, xviii, 1, pp. 99–106, 3 figs., 1 diag., 1943.

The fumigation of citrus trees in Southern California with hydrocyanic acid for insect control, at certain times of the year and under certain environmental conditions, produces an irregular and excessive growth of the outer peel, known locally as 'ridging' or 'cox-combing'. By tests carried out for over two years in commercial groves in coastal and inland regions, a relation was established between the time of year when fumigation was effected and the amount of fruit damage.

With navel and Valencia oranges and grapefruit the highest percentage of affected fruits occurred when the trees were fumigated in February. Lemon fruits were observed to become severely affected if the trees were fumigated at any time from late January to April, inclusive. It is, therefore, evident that the ridging depends on the stage of development of the fruit buds when fumigation is carried out. If the trees are fumigated before or after this stage is reached, only the natural percentage (0·1 to 1·5) of ridged fruits will develop.

The effect of the hydrocyanic acid is not carried over to the following year, the development of the ridges and sectors is not correlated with fruit size, and the phenomenon is confined to the outer rind (flavedo).

Progress Reports from Experiment Stations, season 1941–42.—183 pp., 1 fig., London, Empire Cotton Growing Corporation, 1943.

These reports [cf. *R.A.M.*, xxi, p. 414] contain, *inter alia*, the following items of interest. At Barberton, South Africa, a further manurial experiment was carried out on premature leaf-fall associated with *Alternaria* sp. In all plots given compost or potash or both, attack by the fungus was retarded by about three weeks. Better growth has been found to delay leaf-fall, but potash produced equal delay in the onset of symptoms, with very slight increase in growth, and lime increased growth appreciably, without affecting leaf-fall. No treatment prevented infection. The plants in the plots receiving potash, lime, and compost gave excellent growth, appeared to be quite healthy before leaf-fall set in, and gave very good yields; yet even they became severely infected, with some loss of late crop.

Further work at Gezira on leaf-curl resistance showed that all the selections of P.S.S. 700 origin were strongly resistant. Except for M.S.D.S. 87/39–5 and 133/39–8, both of which showed a significant degree of resistance, the M.S.D.S. selections became badly affected. With reference to the generally accepted view that leaf curl is sporadic in its occurrence, it is pointed out that in the test under consideration, an alternate host, *Malvaviscus* sp., was present to the east of the plot, the direction of the prevailing wind during early morning in winter and early spring was from north-east to south-west. In general, infection gradually diminished from the north-east to the south-west and it would seem that spread followed the prevailing wind and originated in the garden to the east of the experiment. Furthermore, leaf curl was first observed on the experimental farm in two foci which were to the south-west of the leaf-curl experimental site, and it is, therefore, likely that the original infection would have come from the south-west corner and spread from there, had not spread been determined by the direction of the prevailing wind.

In the Gezira, also, seed of 259 types of dura (*Sorghum* spp.) was inoculated with *Sphacelotheca sorghi* and sown out. Four types failed to germinate, 169 types became infected, 60, which headed normally, did not develop the disease, and 26 failed to form heads and could not be tested.

At Shambat the N.T. 2 and X 1730 strains of the seventh back-cross composition containing blackarm resistance factors B_1 and B_2 were propagated in bulk, ninth back-crosses were grown, and from them seed was produced for next season's propagation plots. This completes the breeding programme for blackarm-resistant Sakel varieties from American Upland (Uganda B. 31) crosses.

Transference of the linked blackarm resistance factors B_2 B_3 from *Gossypium punctatum* to N.T. 2 and X 1730 strains was carried to the sixth back-cross stage. B_3 is semi-dominant, but in the homozygous state is the strongest resistance factor yet found. The task of flagging blackarm-resistant Sakel with *arboreum* gene R (reddish flowers and leaves) was virtually completed.

Twenty American Upland strains were classified on blackarm resistance, and the Uganda variety SP84R was sorted into its resistant and susceptible components, and seed homozygous for B_2 was produced for bulk preparation. A beginning was made towards transferring B_3 to SP84R, 511D, Deltapine, and XA 129, the object being the synthesis of blackarm-resistant American Upland types for Equatoria.

In Uganda blackarm was severe in many parts of Teso District, but at Serere it was not abnormal. Evidence was obtained that lesion counts are the summation of a number of effects, of which inherent resistance is only one, others being the amount of primary infection carried by the seed, and the size of the plant [cf. ibid., xx, p. 102]; it is possible, however, that in Uganda blackarm may be controlled, perhaps, by a number of genes and modifiers, so that a single observation, which represents the summation of them, may always have some value.

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Vol. XXII | SEPTEMBER | 1943

Wager (V. A.). **Pythiaceous fungi on Citrus.**—*Hilgardia*, xiv, 9, pp. 535–548, 2 figs., 1942.

The following fungi were isolated during the season 1939–1940 from fibrous dead roots of orange and lemon trees showing dying-back or decline in 22 different localities in southern California, in order of frequency: *Pythium ultimum, Phytophthora citrophthora, Pythium vexans, P. de Baryanum, P. rostratum,* and *Phytophthora parasitica* (the last three from only one locality each). More common than any of these, *Fusarium solani* was found on most of the roots from all localities. Inoculations of orange and lemon fruits with cultures of the above fungi and several others recorded on citrus, yielded the following results: *P. citrophthora, P. parasitica, P. palmivora,* and *P. cactorum* produced a brown rot of fruits whether the inoculum was placed on the surface of the fruit or in shallow or deep wounds; *P. syringae* and *P. megasperma* produced no infection on uninjured fruit and a slow, brown, leathery rot in shallow and deep wounds, while *P. cinnamomi,* which was also unable to infect uninjured fruit, produced a firm, brown, leathery rot of a slightly drier type inside than that produced by the other species; *Pythium ultimum* and *P. de Baryanum* infected only a few uninjured fruits, but both in shallow and deep wounds they produced a rapidly progressing brown rot of a much softer type than that produced by the *Phytophthora* spp.; *Pythium irregulare* behaved similarly but was much less virulent; *P. vexans* produced a distinctive slow rot in both shallow and deep wounds, characterized by a sunken, brown, slushy area surrounded by a water-soaked zone; and finally, *P. rostratum* and one strain of *P. vexans* (with a coiled antheridial branch) failed to infect altogether.

The author gives the geographical distribution of the seven species of *Phytophthora* and tables of morphological and physiological characters of *Pythium* and *Phytophthora* spp. on citrus.

Instructions to Lemon pickers.—*Calif. Citrogr.*, xxviii, 6, p. 144, 1 fig., 1943.

To avoid causing injuries favouring decay by blue and green moulds [*Penicillium italicum* and *P. digitatum*] Californian lemon-pickers are advised always to make two cuts with the clippers, the first leaving at least ¼ in. of the stem, and the second proceeding squarely across the stem next to the button. The button itself must not be cut. Ladders should be placed against the trees in such a way as to avoid breaking the limbs or damaging the fruit. The ladder must never be thrown into the tree. When the fruit is transferred to the field box, the whole bag should be lowered carefully into the box, and the fastening and fold loosened; the bag is then drawn away upwards, and the fruit allowed to roll gently into the box. Care must be taken to see that the box contains no sand, gravel, or twigs before any fruit is placed in it. Decayed fruit and fruit picked up from the ground should not go into the box.

Smith (A. L.). **Lightning injury to Cotton.**—*Phytopathology*, xxxiii, 2, pp. 150–155, 2 figs., 1943.

Since 1936 the writer has inspected a number of cotton fields affected by lightning

injury, which is prevalent throughout Georgia from May to September, assuming a variety of forms, the sudden destruction of well-defined, circular areas being the most frequent and conspicuous. Of rarer occurrence and less easy to diagnose is a dispersed type of damage, in which no evidence of the trouble appears until ten days or more after the storm, when scattered plants turn red, wilt, and die, while numerous gradations between these two symptom complexes are also encountered. In plants suffering from the immediate effects of lightning, death is due to the collapse of tissues outside the xylem on the stems, tap-roots, and larger roots, while in those surviving for varying periods a collar-like enlargement usually appears at or just below soil-level, where complete or occasionally partial girdling takes place. Other features of the delayed form of injury include the formation of irregular, elongated, necrotic areas on the stems. The stem bases and roots of lightning-struck plants of *Gossypium hirsutum* are frequently invaded by *Rhizoctonia bataticola* [*Macrophomina phaseoli*], a parasite of certain Asiatic species of cotton [*R.A.M.*, xxii, p. 204.]

DESCHIENS (R.). **Sur l'emploi des Hyphomycètes prédateurs dans la prophylaxie des infestations à nématodes des végétaux.** [On the use of predatory Hyphomycetes in the prophylaxis of nematode infestations of plants.]—*C.R. Acad. Sci., Paris*, ccxv, 3, pp. 148–151, 1941.

In order to test the practical utility of certain species of Hyphomycetes found preying on nematodes in nature, the writer added to Petri dishes, each containing 100 larvae of *Heterodera marioni* from *Begonia* roots, two squares, 1 by 1 cm., of cultures of these fungi on a medium consisting of 1 gm. oats chaff, 5 c.c. malt extract, 12 gm. agar, and 1,000 c.c. distilled water [*R.A.M.*, xxii, p. 166]. Under these conditions *Dactylella bembicodes* captured and destroyed 90 per cent. of the larvae in ten days, while *Arthrobotrys oligospora* and *D. ellipsospora* required 15 to 20 days to produce comparable effects. In another test, squares of an agar culture of *D. bembicodes* were buried in damp, heavily infested soil at a depth of 5 cm., attached to a piece of silk woof which was connected with the soil surface by a thread. After 15 days four to five larvae per sq. mm. of the woof were found to have been captured. With a view to obtaining some indication of the range of the predators, spores of *D. bembicodes* were affixed to fragments of straw placed side by side 2 to 3 mm. apart at the rate of 100 gm. per kg. soil. After 15 days hyphae had developed within a radius of 1·5 to 2 cm. from the centre of the straw nucleus.

MADSEN (D. E.). **Some studies of three pathogenic fungi isolated from animals.**—*Cornell Vet.*, xxxiii, 4, pp. 383–389, 8 figs., 1942.

The fungi discussed in this paper are an orange-pigmented species of *Actinomyces* isolated from a Cocker spaniel dog, identified as *A. canis*, a *Cryptococcus* of the *Torula histolytica* (American Type Culture Collection No. 428) type from two guinea-pigs inoculated with purulent lymph glands from a cow, and *Blastomyces dermatitidis* from a male hound.

The *Cryptococcus*, for which the designation *C. rotundatus* is adopted, following Dodge's system of classification [*R.A.M.*, xv, p. 368], differed from the type in its rugose growth on carrot agar at 20 days, dull surface on most culture media, rather pale coloration, and inversion of sucrose.

B. dermatitidis occurred in the affected tissues exclusively in the form of spherical to piriform yeast cells, 5 to 22 μ in diameter, containing refractive globules of food material and enveloped by a doubly contoured wall, 1·5 to 2 μ in thickness. On standard media at room temperature the fungus produced only branched, septate hyphae, 2 to 10 μ in diameter, but on glycerine phosphate agar, chlamydospores, conidia, and terminal hypnospores were abundant. Growth on solid media was mealy at 37° C. and prickly at room temperature; under the latter conditions a

white, woolly mycelium, based on a white, leathery membrane, developed in 10 to 14 days. Incubation at room temperature resulted in the formation of a purple, glistening, very adherent, dome-shaped colony, with coarse, purple spicules radiating upwards and outwards.

All the fungi induced morbid changes in the chorio-allantoic membrane of the developing chick [ibid., xxi, p. 79]. *A. canis* was pathogenic to the rat, mouse, guinea-pig, dog, and cat, while *C. rotundatus* and *B. dermatitidis* were, in general, of a relatively low order of virulence.

Schouten (G. B.). **Achorion del tipo milochevitchi (Langeron y Baeza) favus del cuero cabelludo.** [*Achorion* of the *milochevitchi* type (Langeron & Baeza) as the cause of favus of the scalp.]—*An. Inst. Biol. Univ. Méx.*, xi, 1, pp. 51–56, 3 figs., 1940.

A species of *Achorion* isolated from the scalp of a ten-year-old boy at Asunción, Paraguay, produced on 2 per cent. glucose agar and other media whitish-yellow, later light chestnut-coloured colonies: at the end of a month irreversible pleomorphism developed in the malt agar cultures. Numerous aleuria were formed terminally or in clusters along the hyphae, while terminal, intercalary, and concatenate chlamydospores were also observed, those in the first-named position sometimes occurring in the form of 'candelabra', a phenomenon regarded by Langeron as indicative of maladjustment to the environmental conditions. On the basis of these characters the organism was identified as *A. milochevitchi* [*R.A.M.*, xx, p. 164].

Gonzalez Ochoa (A.). **El Microsporum canis (Bodin y Almy, 1879) en México.** [*Microsporum canis* (Bodin & Almy, 1879) in Mexico.]—*Rev. Inst. Salubr. Enferm. trop.*, ii, 3–4, pp. 319–326, 6 figs., 1941. [English summary.]

Out of 135 cases of ringworm of the scalp investigated in Mexico, 13 (9·6 per cent.) were found to be associated with *Microsporum canis*, the remainder being due to *Trichophyton* spp. Three distinct variants of the fungus were observed in pure cultures on Sabouraud's medium (2 per cent. glucose), the most frequent (A) being characterized by white, later canary-yellow to cinnamon-coloured colonies, ultimately assuming a grey coloration owing to the uniform development of a superficial 'down', (B) differing from the foregoing in the presence of grooves radiating from the centre to the periphery, and (C), in which a dirty white veil is rapidly formed, containing an abundance of pluriseptate spindles, 75 by 15 μ, with five to eight locules, some aberrant forms measuring 60 by 18 μ and others small and elongated, approximating to the *Trichophyton* type, and sessile, piriform or subcylindrical, occasionally uniseptate aleuriospores, 2·8 or 3 by 2·5 μ. The propagative organs, which also included racquet-shaped hyphae, tendrils, nodules, and chlamydospores, were sparsely represented in variant (A).

Van Pernis (P. A.), Benson (Miriam E.), & Holinger (P. H.). **Laryngeal and systemic histoplasmosis (Darling).**—*Ann. intern. Med.*, xviii, 3, pp. 384–393, 3 figs., 1943.

The clinical course and post-mortem observations in a case of laryngeal and systemic histoplasmosis (*Histoplasma capsulatum*) in a 63-year-old Latvian male, a preliminary account of which has already appeared (*J. Amer. med. Ass.*, cxvii, pp. 436–437, 1941), are fully described. Tissues and exudates removed from the larynx five months before death were cultured on various media at 37° C. and at room temperature, growth being easily obtainable in three to five days and persisting, predominantly in the mycelial form, through numerous subcultures. The organism develops on many kinds of decaying material, both in sunlight and darkness, the latter condition, as well as humidity, being conducive to growth.

H. capsulatum succumbs to one hour's autoclaving at 15 lb. pressure or half-an-hour's freezing, but was very refractory in dextrose broth cultures to common acids, alkalis, and sulphanilamide derivatives, though showing no resistance to thymol, potassium permanganate, or tartar emetic.

Yeast forms of the fungus, 2 to 4 μ in diameter, were recovered from four out of 15 white mice injected intraperitoneally with 2 to 3 c.c. of a heavy suspension of the mycelial stage, to which they reverted on subculture. Large yeast cells, similar to those described by Moore [*R.A.M.*, xiii, p. 637], were recovered from one of the mice, but on subculturing changed into smaller yeast forms and eventually into the mycelial phase. Cultures from the spleen and liver of mice inoculated with the large yeasts gave rise to the mycelial stage with typical chlamydospores.

NEGRONI (P.). **Transformación 'in vitro' del 'Rhinocladium schencki' en un cultivo levuriforme.** [The conversion *in vitro* of *Rhinocladium schencki* into a yeast-like culture.]—*Rev. argent. Dermatosif.*, xxiv, 1, pp. 471–478, 6 figs., 1940. [French and English summaries.]

The conversion of filamentous cultures of *Rhinocladium* [*Sporotrichum*] *schencki* into yeast-like forms was effected by the addition to a 5 per cent. blood agar medium at 37° C. of saline solution (1 in 2,000 to 1 in 4,000), the process being accomplished in 24 hours. On transference to room temperature the colonies revert to the filamentous phase. The levuriform cells were globular, ovoid, or stalagmoid, and measured 2·25 to 4·5 by 3 (average 3·5 by 2·5) μ; short, moniliform elements were occasionally present. The yeast-like cultures were incapable of fermenting sugars, while the nitrogen auxanogram was positive only for peptone. Pathogenicity to rats was maintained.

A similar observation was made in connexion with *Histoplasma capsulatum.*

SIMSON (F. W.), HARINGTON (C.), & BARNETSON (J.). **Chromoblastomycosis: a report of six cases.**—*J. Path. Bact.*, lv, 2, pp. 191–198, 3 pl., 1943.

Six cases of chromoblastomycosis are reported, the first for South Africa, though Algeria and Rhodesia were already known to harbour the disease. The causal organism was isolated from two of the patients and referred in one case to *Hormodendrum pedrosoi* [*R.A.M.*, xxii, p. 23] and in the other to an unidentified *H.* sp. The dark greyish-green, plush-like colonies of *H. pedrosoi* on 2 per cent. Sabouraud's glucose gave rise to a mycelium composed of long, septate, branching hyphae, 2·5 μ in diameter; sporulation for the first few generations was predominantly of the *Hormodendrum* type, but after repeated subculture on various media most of the spore heads presented a pseudo-acrothecal appearance, no evidence of a *Phialophora* stage having been demonstrated.

The undetermined *H.* sp. was characterized by hyphae similar to the foregoing bearing lateral conidiophores and concatenate conidia, the size of which gradually decreased towards the periphery of the chain, those nearest the conidiophores measuring 8 to 10 by 2·5 to 4 μ and the intermediate elements ranging from 3 to 5 μ in diameter.

MACKINNON (J. E.) & SCHOUTEN (G. B.). **Investigaciones sobre las enfermedades de los cabellos denominadas 'piedra'.** [Investigations on the hair diseases named 'piedra'.]—*Arch. Soc. Biol. Montevideo*, x, 4, pp. 227–266, 26 figs., 1942. [English summary.]

Two distinct conditions are known as 'piedra', one black and the other white, the following being among the differences observed between them, based on three cases studied by the writers in Paraguay in comparison with material from Uruguay, Venezuela, and Europe. The nodosities of the black type are dark brownish to black and very hard, while those of the white form are light brown, the former

being much the more common of the two. Both occur in South America, the black form also in Cochin-China and Java, and the white in Europe and Japan. Black piedra is found on healthy hair, whereas the white type appears to require alterations of the substratum before producing nodosities. The causal organisms of the black and white forms of the disorder are *Piedraia hortai* [*R.A.M.*, xx, p. 203] and *Trichosporon beigelii* [ibid., xvii, p. 600], respectively. Synonyms of the former species are *T. paraguayo*, *P. sarmentoi*, *P. venezuelensis*, *T. venezuelensis* Del Corral, 1934, *P. surinamensis*, *P. colombiana* p.p., and *P. javanica* [ibid., xx, p. 534], while those of the latter (numbering 18) include *T. ovoides*, *T. cerebriforme*, *T. granulosum*, *T. humahuaquensis* [ibid., xviii, p. 526], *P. colombiana* p.p., and *T. minor*.

Conant (N. F.) & Howell (A). **The similarity of the fungi causing South American blastomycosis (paracoccidioidal granuloma) and North American blastomycosis (Gilchrist's disease).**—*J. invest. Derm.*, v, 6, pp. 353–370, 4 pl., 1942.

The writer describes and discusses his comparative studies on eight cultures obtained from cases of South American blastomycosis or paracoccidioidal granuloma (three of which were referred to *Paracoccidioides brasiliensis* and two to *P. cerebriformis*), and seven of the North American form of the disease (*Blastomyces dermatitidis*), isolated from patients at the Duke Hospital, Durham, North Carolina [*R.A.M.*, xx, p. 116; xxi, p. 489]. The media used were Sabouraud's dextrose, beef infusion, beef extract, blood, and glycerine agars, and two series of tests were run, one at room temperature and the other at 37° C. All the strains were tested for pathogenicity by intraperitoneal injections on white mice with 1 c.c. of a 1 : 200 suspension (by volume) of the yeast-like form produced in one-week-old cultures on blood agar at 37°.

All the isolates of *B. dermatitidis* at room temperature exhibited, at one time or another, the three cultural types assigned to this fungus, viz., mealy, prickly, and filamentous. In the early stages of growth, the hyphae intermingled with the single or budding, round, thick-walled elements, 7 to 18 μ in diameter, were broken up into arthrospores, 4 to 6 by 2 to 2·5 μ, but as development proceeded, the growing ends narrowed to 1·5 to 2 μ in diameter, septa appeared at intervals of 10 to 15 μ, and numerous raquette cells, intercalary chlamydospores, and atypical hyphal swellings were observed in the submatrical mycelium: by this time the *Oidium*-like appearance of the colonies had disappeared. The production of aerial mycelium was accompanied by the formation of sessile, round to oval conidia, 3 to 4 μ in diameter, and of a round to piriform type, 4 to 5 μ in diameter, borne on lateral sterigmata of varying length. Round to piriform chlamydospores, 7·5 to 18 μ in diameter, with thick, sometimes wavy, peculiarly sculptured walls reminiscent of *Scedosporium*, developed in profusion in old cultures.

On transference to the incubator, the cottony, aerial growth of the room-temperature cultures became either smooth and waxy or cerebriform and wrinkled. The yeast-like, budding forms of the fungus were accompanied by short, thick-walled, square-ended cells of the *Oidium* type, occurring singly or in chains of three or four. The process of conversion from the filamentous to the yeast-like type of growth was followed microscopically in Van Tieghem cell cultures inoculated with the mycelial form and incubated at 37°.

B. brasiliensis (the name applied to the various South American strains) was characterized in the early stages of growth at room temperature by cerebriform colonies, which subsequently became covered with a short, aerial, filamentous, white to light brown growth. Many round to piriform, thick-walled budding forms, 3 to 25 μ in diameter, were present at first, and the mycelium was composed of thick-walled cells, 4 to 7 by 2 to 3 μ, which readily dissociated into arthrospores. In older cultures numerous intercalary and terminal chlamydospores and atypical hyphal swellings were produced by the submatrical mycelium, while round to

piriform, sessile conidia, 3 to 25 μ in diameter, developed on the short aerial mycelium.

At 37°, five of the South American strains consisted mainly of round, multiple budding cells, with a few short, moniliform chains of two to five cells, while in the other two strains the relative proportions were reversed; the buds produced on the surface of the large, thick-walled cells were round to oval, 1 to 15 μ in diameter, or bacilliform.

The differences observed in the cultural development and clinical behaviour of the North and South American blastomycoses are considered to be of specific rather than of generic importance. *B. dermatitidis* is retained (pending the general acceptance of a more appropriate name) for the agent of the North American disease, and the various designations proposed for the South American granuloma relegated to synonymy with *B. brasiliensis*.

Ware (W. M.) & Glasscock (H. H.). **Flax rust.**—*J. Minist. Agric.*, l, 1, pp. 16–18, 1943.

During the spring and summer of 1942, flax rust (*Melampsora lini*) was observed in Kent and Sussex, over half the acreage under the crop being affected in the former county and some of the stands so severely damaged as to be useless for scutching; these were rejected by the factories. Infection is perpetuated through the seed, farm debris, and by-products of manufacture, such as 'chaff', consisting of fragments of the seed bolls, flower stalks, and main stems, poorly germinating and 'tail' seed (used for cattle cake), 'shives' (bits of stem, fibre, and root serving as manure), and dust, employed as a 'conditioner' for fertilizers. Control should therefore be based on the use of clean seed and the avoidance of contact between the site selected for the next season's crop and such sources of infection as the harvested stand (commonly stacked on the farm, sometimes for many months, until required for scutching), and the above-mentioned by-products. Other measures tending to reduce the incidence of rust include crop rotation and early sowing (first week of April in the south of England).

Since the outbreak of war the area under linseed has been widely extended, and the straw and chaff of this variety of flax, the former used for bedding and later as manure, and the latter for fodder, also constitute important sources of contamination for the fibre crop. Another risk of propagation of the rust lies in the presence in or near the fields of 'volunteer' flax plants, which may well act as annual hosts, enabling the organism to pass to cultivated crops in the vicinity. On 20th January, 1943, for instance, self-sown seedlings on a Kentish farm were found to bear uredo pustules. *Linum catharticum*, a common field weed, is not susceptible to the physiologic race of *M. lini* attacking cultivated flax.

Adam (D. B.) & Stokes (Joan). **The association of Rhizoctonia bataticola with retting Flax in South Australia.**—*Proc. Linn. Soc. N.S.W.*, lxvii, 5–6, pp. 313–317, 1942.

A sclerotial fungus, the morphological, physiological, and pathological characters of which correspond with those of *Rhizoctonia bataticola* [*Macrophomina phaseoli*], has been observed to be widespread at the Waite Agricultural Research Institute, Adelaide, and elsewhere in South Australia, on flax maintained at a temperature of 80° to 90° F. for retting. The organism is also present, though not in such abundance, on flax undergoing 'dew-retting' in the field. Its vigorous development rapidly induces 'over-retting' and impairs the quality of the fibre.

On Dox's and potato dextrose agars the diameter of the sclerotia ranged from 63 to 165 (mean 97) and 50 to 181 (113) μ, respectively. The most rapid increase in colony diameter (49 mm. in 24 hours) took place at a temperature of 32·5° C. Dextrose was shown to be the best source of carbon, closely followed by xylose,

while pectin, cellulose, and starch were also utilized, though less extensively. In a series of cultures on a modified synthetic cotton root agar medium [*R.A.M.*, xviii, p. 249], the hydrogen-ion concentration of which was adjusted to range from P_H 3·4 to 10·6, growth was about equally luxuriant from 5 to 8, at 3·4 it fell to a quarter, and at 10·6 to half the optimum. As in the experiments carried out by Taubenhaus (*Phytopathology*, iii, pp. 159–166, 1913), the writers' strain of *M. phaseoli* produced 'charcoal rot' of sweet potatoes incubated at 25° for four weeks.

The fungus is believed to be a natural occupant of some, possibly many, South Australian soils.

FLOR (H. H.). **Chlorotic dieback of Flax grown on calcareous soils.**—*J. Amer. Soc. Agron.*, xxxv, 4, pp. 259–270, 3 figs., 1943.

Chlorotic die-back of flax is a non-parasitic disease prevalent in certain unproductive soil areas in the Red River Valley of North Dakota. The leaves formed on the primary stem during cool, wet weather are acutely chlorotic, and if the adverse conditions persist for several days the terminal bud is killed and the stem dies back to the cotyledonary node, from which lateral branches are sent out, except in severe cases when the entire plant succumbs. With the advent of warm weather many of the plants recover and produce a certain amount of seed. If the soil is dry during a cool period, there is little chlorosis, but the cotyledons assume a greenish-bronze cast and the whole plant presents a pinched appearance, the stunted leaves developing necrotic flecks, which expand and lead to premature defoliation.

When Bison flax is grown experimentally in soils representing successively deeper layers, the symptoms are mildest in the surface soil and increase in severity with each lower horizon. No indication of the presence of a toxic substance in the unproductive areas could be detected on the basis of chemical tests, or from a comparison of the growth of plants in steamed or leached and untreated soil. Of the various mineral amendments applied to the 0 to 6 and 7 to 12 in. horizons of Fargo clay soil in greenhouse tests, sodium dihydrogen phosphate (840 lb. per acre) and, to a lesser extent, sodium nitrate (400 lb.), were the only ones that improved the growth of the plants, presumably by correcting the unproductive tendency of the soil.

The chlorotic phase of the disease was more noticeable in the wetter soils, but stunting, foliar necrosis, and stem die-back were equally prevalent at lower water-holding capacities. The symptoms were most acute at low soil temperatures, and showed a progressive diminution in intensity from 12° to 25° C. Applications of phosphate to Bearden silt loam corrected its unproductiveness and the chlorotic condition of the flax plants, similar treatment of the Fargo clay being less effective. It is suggested that the trouble at low soil temperatures is at any rate partially due to the deficiency or unavailability of essential minerals, notably phosphate, in the highly calcareous alkaline soil.

D'OLIVEIRA (MARIA DE L.) & CABRAL (R. V. DE G.). **Doenças bacterianas da plantas diagnosticadas em Portugal.** [Bacterial diseases of plants diagnosed in Portugal.]—*Rev. agron., Lisboa*, xxx, 2, pp. 176–184, 7 figs., 1942.

Particulars are given of the writers' studies on some bacterial plant diseases in Portugal [*R.A.M.*, xviii, p. 825; xxi, p. 243] in connexion with which the following points may be mentioned. *Bacterium ligustri*, first observed on privet in various Lisbon parks and gardens in 1936 (*Rev. agron., Lisboa*, xxiv, pp. 425–435, 1936), differs from the closely related *Phytomonas* [*Pseudomonas*] *syringae* in its action on milk and sugar-fermenting capacities. Inoculation experiments with *P. syringae*, the agent of a lemon rot of commercial importance, gave positive results on wounded

fruits of the same host, sweet and sour oranges, pear, peach, and tomato, as well as on bean [*Phaseolus vulgaris*] pods, and on lily, sweet and sour orange, lime, apricot, and peach plants.

Comparative studies were carried out on *Bact.* (*Phytomonas*) [*Xanthomonas*] *begoniae*, the agent of *Begonia tuberosa* leaf spot at Cintra, *P. flava-begoniae*, originally described by Wieringa from Holland [*R.A.M.*, xvii, p. 749], and *Bact.* [*X.*] *flavo-zonatum* from the United States [ibid., xviii, p. 740], the results of which indicated that a single species is involved in the causation of a disease expressed by a variety of external symptoms dependent on environmental conditions.

DIMOCK (A. W.). **Controlling Septoria leafspot of the Chrysanthemum.**—*Bull. Chrysanth. Soc. Amer.*, x, 1, pp. 6–11, 1942. [Mimeographed.]

In amplification of an abstract of investigations on the control of *Septoria* leaf spot of chrysanthemums [*R.A.M.*, xxii, p. 24, stated by the author *in litt.* to have been carried out with *S. obesa* (ibid., vii, p. 244), while *S. chrysanthemella* is being studied], the following information on the life-history of the former fungus may be presented. The pathogen overwinters on diseased leaves left on the ground in the autumn, its spores being disseminated by splashed or wind-blown water or by mechanical transfer on workmen's clothing, tools, and the black cloth covering over the plants when the foliage is wet with rain or dew; they may be splashed upwards to a height of 16 or 18 in. The host tissues are penetrated almost exclusively through the lower leaf surfaces, at least 24 hours' contact with which is a necessary preliminary to the entry of the fungus, while an incubation period of 10 to 14 days elapses before the appearance of the symptoms, this in its turn being followed in four to six days by the production of a new crop of spores.

DIMOCK (A. W.). **Coming up-to-date on Verticillum wilt and Septoria leafspot of Chrysanthemum.**—*Bull. Chrysanth. Soc. Amer.*, xi, 1, pp. 3–10, 1943. [Mimeographed.]

Virtual immunity from *Verticillium* wilt in chrysanthemums may be secured [*R.A.M.*, xx, p. 247] by the use of so-called 'cultured stock', i.e., shoots from rogued stock plants, surface-sterilized slices of which have been grown for a minimum period of ten days on sterilized agar in Petri dishes to determine the presence or absence of the pathogen. Each dish is occupied by only one slice and is labelled with a designation corresponding to that affixed to the shoot. The shoots demonstrated by this procedure to be free from the fungus are retained and rooted in sterilized soil for further use as stocks, while diseased material is discarded. That the treatment does not completely eliminate the organism is shown by the recurrence of infection among 'cultured' stocks replanted in old contaminated soil. Thus, on sterilized soil, only 6 per cent. of 'cultured' stock of the highly susceptible E. A. Seidowitz variety had to be rogued out, whereas over 50 per cent. of the 3,000 plants on unsterilized soil were rendered unmarketable by the disease. It remains to be seen whether the advantages derived from this somewhat complicated method justify the expense entailed in the provision of the necessary equipment and other facilities, training of personnel, and so forth.

In further tests in 1942 on a number of materials for the control of *Septoria* [*obesa*: see preceding abstract], 4–4–100 Bordeaux mixture, plus Du Pont (formerly known as Grasselli) spreader-sticker at 1 in 2,000, again gave excellent results, fully equal to those previously obtained with the 8–8–100 concentration; the same fungicide may be used at a strength of 2–2–100 for the later applications or during hot, damp weather when the risk of spray burn is greatest. Fermate, 1 or 1½ lb. per 100 gals. plus Du Pont spreader-sticker at 1 in 2,000, also gave remarkable control, reducing the incidence of mortality from 76 to 4 per cent., the comparable figure for Bordeaux being 7. Further experiments with this preparation are recommended,

the suggested strength for early and late treatments being 1 and ½ lb., respectively, with an admixture of the spreader at 1 in 4,000. Some of the fungicides which appeared promising in the 1940–1 trials, e.g., C–O–C–S spray, cuprocide, and fungisul, were less effective under the much more exacting conditions of 1942.

KOTTHOFF (P.). **Der rote Brenner der Amaryllis.** [Scorch of *Amaryllis*.]—*Kranke Pflanze*, xix, 11–12, pp. 106–107, 4 figs., 1942.

Amaryllis vittata [*Hippeastrum vittatum*] hybrids are stated to have been extensively infected by scorch (*Stagonospora curtisii*) [*R.A.M.*, xviii, p. 572] in western Germany and elsewhere after the first world war, and the writer has recently observed a recrudescence of the disease in Westphalian nurseries. Its symptoms and the life-history of the causal organism are briefly described in semi-popular terms. Control presents difficulties, since the pathogen overwinters in the bulb and thence passes to the inflorescences or leaves. Infection may also be conveyed to healthy plants by splashing water or insects, the germ-tubes entering the host tissues through the stomata. The fungus is sensitive to desiccation, and in the writer's experiments spores kept in a dry state were no longer viable after a fortnight, while those freshly emerged from the pycnidia germinated only at a high relative humidity (over 71 per cent.). A saturated atmosphere and a temperature of 22° to 24° C. form an ideal combination for the development of *S. curtisii*, and control measures should be based on the provision of a comparatively low temperature and dry air.

HARDISON (J. R.). **The occurrence of amphispores in the leaf rust of Bluegrasses.**—*Mycologia*, xxxv, 1, pp. 79–82, 2 figs., 1943.

Abundant development of amphispores was observed in 1941 in the uredosori of *Puccinia poae-sudeticae* on a single nursery row of *Poa pratensis* plants grown at the Botanical Garden of the University of Michigan. This is stated to be the first record of amphispores in this rust. The amphispores are described as minutely echinulate, 19 to 23 by 21 to 28 μ, the wall 1·7 to 2·6 μ thick, with six scattered pores, and with the pedicel generally persistent, colourless, once to twice the length of the spore. The amphispores failed to germinate at maturity, but when placed in cheesecloth bags out of doors in October, 2 per cent. of them germinated in February, and 15 to 20 per cent. in April of the following year. When seedlings grown from seed of the same collection of *P. pratensis* on which amphispores were originally collected were inoculated with amphispores, uredosori developed after seven days, but no amphispores were present 26 days after inoculation. The abundant capitate paraphyses accompanying the uredospores provided unmistakable evidence of the connexion of the amphispores in the life-history of *Puccinia poae-sudeticae*. Amphispores were not observed on other collections in the same nursery or on a large number of specimens of the rust collected throughout Washtenaw County, Michigan. It is suggested that the production of amphispores might be related to the physiology of the host plant peculiar to the single grass collection.

ANDREWS (E. A.). **Seedling blight and root rot of grasses in Minnesota.**—*Phytopathology*, xxxiii, 3, pp. 234–239, 1943.

From 1,500 seeds of 11 species of grasses *Helminthosporium*, *Alternaria*, *Fusarium*, *Cladosporium*, and *Penicillium* spp., and a number of unidentified fungi and bacteria were isolated on acid potato dextrose agar at the Minnesota Agricultural Experiment Station. *H. sativum*, isolated from *Bouteloua gracilis* roots, caused severe pre-emergence killing, reduction of root development, and stunting of *Agropyron cristatum* and *Bromus inermis* in the greenhouse, while *Pythium graminicola* from *A. cristatum* roots induced comparable symptoms on the same two hosts at soil temperatures ranging from 12·3° to 31·5° C. The reduction of stand due to

P. graminicola was not so heavy as that resulting from infection by *H. sativum*, while a species of *Fusarium* and *Rhizoctonia* [*Corticium*] *solani*, also isolated from *A. cristatum*, were of only moderate virulence and non-pathogenic, respectively. *P. graminicola* was responsible in greenhouse tests for severe pre- and some post-emergence killing of 14 species of grasses, including *A. pauciflorum*, *A. smithii*, *Andropogon furcatus*, *A. scoparius*, *Elymus canadensis*, and *Panicum virgatum*.

RICHTER (B.). **Der Einfluss des Stengelbrenners auf den Wuchs und Ertrag der Serradella.** [The influence of anthracnose on the growth and yield of Serradella.]—*Kranke Pflanze*, xix, 9–10, pp. 86–91; 11–12, pp. 101–105, 1 graph, 1942.

This is a discussion of the effects of anthracnose (*Colletotrichum trifolii*) on the growth and yield of serradella [*Ornithopus sativus*], and on the relation of cultural practices, especially time of sowing, to the development of infection. As already shown by Hay *et al.* [*R.A.M.*, xvii, p. 754], the postponement of sowing until 10th to 15th June obviates the risk of infection, but it is pointed out that the yields of such late crops tend to fall below the average, so that the provision of a supporting crop is advisable. Stephan (*Mitt. Landw., Berl.*, xxviii, p. 632, 1938) has shown that serradella is capable of assimilating exceptionally large amounts of potash with beneficial effects on production. The crop thrives in soils with a slightly acid reaction (P_H 5·2 to 5·5).

HADORN (C.). **Der Schorf und seine Bekämpfung. Weitere Untersuchungen über die Vorratsspritzung. Untersuchungen über die Wirkungsweise verschiedener Spritzbeläge auf die Keimung der Sommersporen des Apfelschorfpilzes. Neue Grundlagen für die Bekämpfungsmassnahmen.** [Scab and its control. Further investigations on the 'reserve spray'. Investigations on the mode of action of various spray coverings on the germination of the summer spores of the Apple scab fungus. New bases for control measures.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 6, pp. 156–171, 204–232, 9 figs., 8 diags., 1 graph, 1943.

Further investigations on various aspects of the apple scab [*Venturia inaequalis*] control problem in eight climatically divergent regions of Switzerland [*R.A.M.*, xxi, p. 375] led to the following main conclusions. All the experiments revealed the paramount importance of a quick repetition of the pre- and post-blossom treatments. The flowering period is critical, and two pre- and two post-blossom applications at 10- to 14-day intervals should be given wherever possible, especially in the case of varieties liable to infection at a very early stage, such as Gravenstein, Kassel, and Landsberg [Reinettes], Stäfner Rosen, Sauergrauech, and Beauty of Boskoop. Effective control of early scab is likewise the best preventive of storage infection.

During the three experimental years the best results were given by the 'maximum' (eight-spray) schedule, while the 'normal' (five applications without copper) was also reasonably satisfactory for dessert and keeping apples. Adequate control was further obtained with a schedule ('normal' with copper) in which copper oxychloride was mixed with the lime-sulphur spray in order to dispense with two blossom treatments, but in spite of its great technical advantages this procedure is considered to entail undue risks.

Pomarsol was shown both by laboratory and orchard trials to possess outstanding fungicidal properties. Like Bordeaux mixture, its active principle goes into solution and confers protection on the still untreated foliage merely by dripping from the crown; in this respect pomarsol is superior to lime-sulphur, but its adhesiveness must be increased before it can be applied for treatments at long intervals, e.g., against late scab.

The 'reserve spray' is considered to be the sole effective means for the simplifica-

tion of the summer spray schedule, but the physico-chemical attributes of the mixture still leave room for improvement. There is, for instance, a wide gap between the amount of copper in the accumulated reserve (covering) of a 4 per cent. Bordeaux mixture (1,000 gm. metallic copper in 100 l.) and the minimum effective concentration of 0·1 gm. metallic copper in 100 l. dripping water. Unduly large amounts of copper are washed off in the early stages of contact with the foliage, and this often results in severe damage to the young leaves, besides appreciably curtailing the duration of the protective effect of the covering on the exposed portions of the crown. Bordeaux mixture remains, however, the most practical 'reserve spray'. The fact that Kassel Reinette, Champagne, and Bell apples remain perfectly free from infection under the protection of impregnated nets or matting, even though the copper content of the dripping water sinks below 0·1 gm. per 100 l. by the end of May (C. Zäch's analyses [cf. ibid., xxi, p. 376]), is interpreted as proof that (*a*) the risk of infection in these varieties begins very early and is of brief duration, and (*b*) secondary infections do not occur in the absence of primary ones: in other words, no late without early scab.

In preliminary laboratory tests carried out at the Wädenswil Experiment Station to determine the relative merits of the 'film' and 'drop' spray coverings in the inhibition of conidial germination in *V. inaequalis*, the former was found to afford better protection, irrespective of the chemical composition of the fungicide, but the formation of a 'film' makes very exacting demands on the suspensory capacity, fineness, moistening property, and adhesiveness of the mixture, the first-named attribute being decisive for its uniform distribution. A coating of this kind can only be obtained by spraying so thoroughly that the entire leaf, fruit, and branch surface is completely moistened. A sealed and unbroken 'film' is essential to the efficacy of preparations with little or no 'distance effect', such as lime-sulphur plus iron sulphate or copper oxychloride, and copper carbonate. In the case of fungicides of the pomarsol or 2317W. type, with a superior 'distance effect', a few gaps in the interior of the crown are of less importance, since the dripping water distributes the active principle from leaf to leaf as long as reserves are available. A spray pressure of 12 atmospheres at the nozzle of the tube, with an aperture 1·3 to 1·8 mm. in diameter, was found to produce the rapid and thorough distribution of the fungicide necessary for 'film' formation, and the use of apparatus producing a fine 'mist' is not indicated.

LOEWEL (E. L.) & SEEMANN (F.). **Das Verhalten der Bienen gegenüber den gebräuchlichen Spritzmitteln des Obstbaues.** [The reaction of Bees to the orchard sprays in everyday use.]—*Forschungsdienst*, xii, pp. 75–87, 1941. [Abs. in *Chem. Zbl.*, cxiii (i), 1, p. 99, 1942.]

In tent experiments in the Jork district [Schleswig-Holstein] from 1937 to 1940, copper chloride sprays [for apple scab (*Venturia inaequalis*) control] were completely non-toxic to bees, whereas home-made Bordeaux mixture caused heavy losses among workers [*R.A.M.*, xxii, p. 140]. Lime-sulphur mixtures were entirely innocuous, and so was pomarsol alone, but the latter in conjunction with copper oxychloride was definitely injurious. Crude nicotine was harmful only to bees brought into direct contact with it. Arsenic was the most deadly bee poison. The data secured from chemical analyses of the collected bees for copper and arsenic agreed with their reactions and mortality rates, so that the results of such tests afford a reliable basis for toxicological calculations. The lethal doses of copper and arsenic were computed at 3·6 and 0·23 to 0·5γ per bee, respectively.

COOLEY (J. S.) & LINCOLN (F. B.). **A disease of Apple grafts and layers caused by a Rhizoctonia.**—*Phytopathology*, xxxiii, 3, pp. 255–257, 1 fig., 1943.

A species of *Rhizoctonia*, possibly *R.* [*Corticium*] *solani*, was consistently isolated

from the margin of dead and living tissue of active lesions on the young underground stems of apple grafts or layers at the United States Bureau of Plant Industry Station, Beltsville, Maryland, and inoculated into young layer shoots with positive results. No previous reference has been found in the literature to a comparable disorder of apple grafts, the symptoms on which resemble those already described in connexion with *C. solani* on holly [*R.A.M.*, xxii, p. 83], but a species of *Rhizoctonia* has been repeatedly isolated by E. A. Siegler (unpublished notes) since 1920 from the roots of apple and peach seedlings, while J. A. Perlberger has reported the occurrence of *R. bataticola* [*Macrophomina phaseoli*] on apple and other nursery fruit trees in Palestine [ibid., xvi, p. 683].

TINDALE (G. B.). **Cool storage of Apples and Pears under 'acquisition' 1942.**—*J. Dep. Agric. Vict.*, xli, 1, pp. 47–54, 1943.

A survey of the Victorian apple and pear crop acquired by the Australian Apple and Pear Marketing Board in 1942 and stored in 91 cool stores throughout the State showed, *inter alia*, that Jonathan apples are subject to soft scald and breakdown if stored at too low a temperature during the early months. Jonathan apples should be stored at a temperature not below 36° F. until the end of April; during May, the temperature can be safely reduced to 34°, and after this month to 32°. In stores where large quantities of Jonathan apples are received, they should be segregated from other varieties (which keep best at 32° from the start) and stored at these temperatures. If it becomes necessary to fill up a Jonathan chamber with other varieties, the temperatures selected should be those suited to the Jonathan apples. It is inadvisable to store Jonathan apples with pears at pear temperatures (29° to 31°) which are much too low for this variety of apple.

Oiled wrappers (to prevent superficial scald) need to be used with Granny Smith apples only if they are to be kept in storage after August. It is suggested, however, that about 20 per cent. of the Stewart, Cleopatra, Delicious, and Rome crops should be oil-wrapped for keeping after September.

CATION (D.). **The rosette mosaic disease of Peach.**—*Tech. Bull. Mich. agric. Exp. Sta.* 180, 24 pp., 5 figs., 1942.

Peach rosette has been present in Michigan [*R.A.M.*, xx, p. 480] for upwards of 25 years, during the last ten of which, however, it does not appear to have spread to any extent. Infection persists on certain orchard sites even after the removal of rosetted trees, and new trees transplanted to such sites frequently develop the symptoms of the disease in the second year. Inoculations were successfully carried out by bud-grafting and placing unsterilized soil from an infected area round the roots of trees of several varieties, of which J. H. Hale, South Haven, and Seedlings Nos. 1 and 2 contracted exceptionally marked and readily recognizable symptoms.

Two forms of rosette have been distinguished, one relatively mild, with an incubation period of a year or more, and the other severe, causing infection during the year following inoculation on ten varieties; one young tree, bud-inoculated near the ground at the close of the dormant period developed the symptoms in three weeks. One damson plum in particular was implicated as a carrier of rosette, which was further strongly suspected to be harboured by other damson and Burbank plums and prunes of an unspecified variety. No symptoms had developed on Abundance and Red June plums two years after inoculation.

A few cases were noted in which peach trees reacted most severely the year following budding, after which a gradual decline of virulence ensued. South Haven appeared to be the most susceptible of the varieties used in the tests, followed by Golden Jubilee, Kalhaven, and Halehaven, while some degree of resistance was shown by Oriole and Amber Gem; and Gold Drop withstood the attacks of the virus better than Elberta.

Jirak (L.). **Über die enzymatischen Vorgänge des Welkens bei jungen belaubten Marillenbäumen.** [On the enzymatic processes involved in the wilting of young Apricot trees in leaf.]—*Gartenbauwiss.*, xvii, p. 18, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 7, p. 738, 1943.]

'Apoplexy' of young apricot trees, characterized by the sudden wilting of portions of the foliage, was shown by the writer's investigations at the College of Soil Science, Vienna, to be primarily attributable to infection by *Sclerotinia cinerea* [*S. laxa*] and *S. fructigena* [*R.A.M.*, xxii, p. 71]. The pectin-dissolving enzymes of the fungi occur in profusion in the water-conducting vessels of the host, where they cause local constriction or displacement through swelling of the intercellular substance. Methoxylase (pectase) is the principal constituent of the enzyme complex of the pathogens. Wilting was experimentally induced with purified pectase extracts from clover leaves.

Lott (T. B.). **Transmissible 'twisted leaf' of sweet Cherry.**—*Sci. Agric.*, xxiii, 7, pp. 439–441, 1 fig., 1943.

In 1938, two cherry trees in a commercial orchard in British Columbia were observed to be considerably smaller than other trees of equal age, and to have leaf symptoms not observed before of a kind for which the name 'twisted leaf' appeared to be fitting. Surveys of over 9,000 trees, nearly all of them sweet cherry varieties, in the Okanagan valley between 1938 and 1941, showed that twisted leaf was present on 13 trees in seven widely separated orchards; of the affected trees five showed conspicuous symptoms in nearly every leaf, and were severely stunted. One tree consistently showed definite symptoms in a few leaves, with very little effect on tree growth or vigour. In some cases, twisted leaf symptoms were found in conjunction with symptoms of other diseases. All the affected trees belonged to the Bing variety, except one, which was a Black Republican.

Three definite symptoms consistently appeared, and remained evident throughout the season. All three did not necessarily develop on every leaf, but their combination is not known to occur in any other disease. These were bilateral inequality, distortion, and necrosis. In the case of the first, the smaller side tended to be more chlorotic, with slightly more acute angles between the midrib and the veins, and with more up-and-down waving of the leaf margin. The midrib was occasionally almost straight, but generally was smoothly curved in the plane of the leaf. As regards the second, in some leaves the distal portion was abruptly bent downwards, this abrupt bend being most noticeable on the midrib and least at the leaf margin. Sometimes the bend was slight, at other times it exceeded a right angle. Similar bends occurred at the union of the blade and petiole or at a point along the petiole. The petioles were variously bent and twisted. The leaf margins often showed a marked up-and-down wave and sometimes were buckled. A bend was generally associated with necrosis of part of the midrib. This was either restricted to the lower surface of the vein, or it occurred on one or both sides. When it spread to the upper surface part of the midrib usually dropped out, as did bits of the lateral veins. Petiole necrosis was, as a rule, more superficial than midrib necrosis.

Other symptoms were also noted. In all trees, affected leaves were small. Severely affected trees showed symptoms not found in slightly affected ones; they were stunted, and the internodes, particularly those on the lateral branches, were shortened, while occasionally, severe defoliation from the base was noted. Leaves sometimes occurred in tufts or clusters, many with blades under 2 in. in length. Two kinds of mottling were also present: a peppering of small yellow spots, generally with minute brown centres, and (less often) short, bright yellow lines near some of the lateral veins. The crops were sometimes reduced and of poor quality.

The condition was experimentally transmitted to all of nine young Bing trees budded or grafted with material from affected trees, symptoms appearing in two months or more. Transmission gave rise to milder forms of the disease.

HUNTER (A. W. S.). **Rust resistant Black Currants.**—*Canad. Hort.*, lxvi, 1, p. 10, 1 fig., 1943.

Very promising results in respect of resistance to white pine blister rust [*Cronartium ribicola*] have been secured during the last two years at the Central Experimental Farm, Ottawa, by crossing a wild black currant from Manchuria with certain commercial varieties. One of the resultant seedlings shows special promise, combining heavy cropping and other desirable features with complete freedom from disease, and it is expected that supplies will shortly be available on the market. Many of the hybrids appear also to be only slightly susceptible to powdery mildew [*Sphaerotheca mors-uvae*].

ZELLER (S. M.) & BRAUN (A. J.). **Decline disease of Raspberry.**—*Phytopathology*, xxxiii, 2, pp. 156–161, 3 figs., 1943.

Large areas of Cuthbert red raspberry plantings in the Willamette Valley of western Oregon are stated to be running out as a result of infection by a graft-transmissible virus, for which the name *Minuor ruborum* or *Rubus* virus 8 is proposed, the disorder itself being termed decline disease. No marked specific features characterize the disease, which causes a gradual diminution in the vigour of canes and roots, accompanied by some leaf-rolling and fluting, the latter symptom being apparent throughout the season on greenhouse plants but only in the late autumn out of doors. Since plant selection has given satisfactory results in the elimination of a bud-perpetuated disease known locally as 'crumbly berry', it is planned to test the certification of planting stock as a control measure against decline.

ZELLER (S. M.) & BRAUN (A. J.). **Stamen blight of Blackberries.**—*Phytopathology*, xxxiii, 2, pp. 136–143, 3 figs., 1943.

The most serious case of stamen blight (*Hapalosphaeria deformans*) observed by the writers in Oregon [*R.A.M.*, xix, p. 31] involved some 70 per cent. of Young dewberry blossoms in a six-acre commercial planting in 1937; by the following year the incidence of infection had sunk to 15 per cent., and since then up to 30 per cent. has been reported on one occasion, so that epidemiology of the pathogen is evidently much influenced by seasonal conditions. The Boysen dewberry and Evergreen blackberry are also susceptible. The diseased anthers, unlike those of healthy flowers, do not dehisce to expose cream-coloured pollen but are covered with the white spore horns of the fungus. Berry production by the emasculated blossoms is dependent on accidental pollination by bees, and the deformed fruits obtained in this manner are usually unsuitable for canning. Entry into the host is effected through the anther walls, the pollen sac being completely surrounded by a pseudoparenchymatous envelope, the pycnidia formed on which erupt on the surface in readiness to discharge coils of pycnospores when the flowers open. Infection takes place through the axillary buds some time between May and the following March. No perfect stage of the fungus has been discovered. Dormant sprays of Bordeaux mixture or lime-sulphur were ineffectual, but about 60 per cent. control was secured by the application of lime-sulphur (4 per cent. of 32° Baumé) in August, 1941.

ROY (T. C.). **A root-rot disease of Mulberry plants (Morus alba L.).**—*J. Indian bot. Soc.*, xxii, 1, pp. 27–35, 1 fig., 3 graphs, 1943.

Diplodia morina was isolated at the Bengal Agricultural Institute, Dacca, from the roots of mulberry plants showing a light brown stain, gradually deepening to

dark brown or black, which was accompanied by wilting of the aerial portions and defoliation. By inoculation experiments with pure cultures of the fungus from a synthetic agar medium containing glucose and peptone, entry into the host was shown to be effected through the epiblema, whence the intercellular spaces of the cortical tissue system were traversed and the phloem reached. From the last-named region the hyphae travelled upwards and downwards, some protruding into the xylem vessels through the pits in the manner of tyloses. The minimum, optimum, and maximum temperatures for the growth of *D. morina* were found to be 12°, 35°, and 40° C., respectively, and a hydrogen-ion concentration of P_H 7·6 was conducive to vigorous development.

CHATTERJI (N. K.). **Anatomical studies in a necrotic Papaya (Carica papaya, L.) plant.**—*J. Indian bot. Soc.*, xxii, 1, pp. 41–50, 1 pl., 11 figs., 1943.

Full details, based on an intensive anatomical study, are given of the pathological changes in the latex vessels, secondary phloem, and cambium of a papaw plant of the Ceylon variety suffering from a foliar disease, presumably of virus origin, the external symptoms of which included hypertrophy, hypoplasia, malformation, the production of numerous secondary large veins, and the formation of papilla-like excrescences on the areas of the leaf blade bordering the veins.

WAGER (V. A.). **Phytophthora cinnamomi and wet soil in relation to the dying-back of Avocado trees.**—*Hilgardia*, xiv, 9, pp. 519–532, 3 figs., 1942.

Further work on the decline of avocado trees associated in southern California with *Phytophthora cinnamomi* [*R.A.M.*, xxi, p. 149] and excessive moisture showed that other fungi present on the roots of affected trees were *Pythium vexans*, *P. ultimum* (on one root), *Fusarium oxysporum*, and *Cylindrocarpon radicicola*. Inoculation tests with *P. vexans* indicated that this fungus grows only in weakened or dead roots, or those already infected by *Phytophthora cinnamomi*. No tests were made with *F. oxysporum* or *C. radicicola*, but they, probably, are no more injurious than *Pythium vexans*.

This is stated to be the first record of *Phytophthora cinnamomi* on avocado in the United States, though the fungus has also been recorded on this host in South Africa and Puerto Rico [ibid., ix, p. 291].

KLOTZ (L. J.) & SOKOLOFF (V. P.). **The possible relation of injury and death of small roots to decline and collapse of Citrus and Avocado.**—*Calif. Citrogr.*, xxviii, 4, pp. 86–87, 6 figs., 1943.

Decline and collapse of citrus and avocado trees in California are, respectively, gradual die-back with leaf-yellowing accompanied by low yield, and rapid wilting followed by death, and are caused by the destruction of feeder roots. In August, 1940, *Phytophthora citrophthora* and *P. parasitica* were isolated from feeder roots of the sour orange stock of a Washington Navel orange tree that had wilted and from injured feeder roots of apparently healthy trees in the vicinity. They were also obtained from a large number of citrus trees, some healthy, in different localities, and *Pythium ultimum* and *Fusarium* spp. were also found. The two former fungi were shown by greenhouse experiments to be capable of attacking and destroying feeder roots of sweet and sour orange seedlings at temperatures ranging from 10° to 30° C.; at 25° and 30° growth was more vigorous and decline slower. Infection experiments with zoospore suspensions of *Phytophthora* spp. on grapefruit, rough lemon, Valencia, and sour orange showed all to be susceptible, whereas Sampson tangelo was outstanding in its resistance. Plants with fibrous roots extensively infected with *P. parasitica,* removed from an infected seed-bed to well-aerated soil in a warm greenhouse, recovered. The rate of production and growth of active roots is believed to be the important consideration.

Decline and collapse in avocado have been shown by Tucker [*R.A.M.*, ix, p. 291] to be associated with *P. cinnamomi* and result from the destruction of the roots. Greenhouse and current field experiments indicate that toxic materials produced during the denitrification induced by conditions of poor aeration and drainage may be responsible for the injury and death of the roots, and for predisposing the roots to attack by *P.* spp. and other fungi. Soil saturation during the rainy season and the presence of organic matter and nitrites in suitable proportions may result in sufficient concentration of toxins to injure roots severely and cause the death of the trees in the subsequent dry weather.

Toxins produced during denitrification were also found to injure or kill citrus roots, and predispose them to attack by parasitic fungi. *P. cinnamomi* and *P. parasitica* are active denitrifiers. In the early stages of nitrite injury, absorption of water by roots is greatly reduced.

It is assumed that in commercial groves the brown-rot fungi are generally present and may take part in root destruction, their action being perhaps supplemented by secondary *Fusarium* spp.

MARTIN (H.). **The evaluation of fungicides. A study in quantitative toxicology.**—*J. Soc. chem. Ind., Lond.*, lxii, 5, pp. 67–71, 1943.

This is a critical survey and discussion of recent researches on the application of bio-assay and physico-chemical methods to the evaluation of fungicides, reference to which has been made from time to time in this *Review*.

STARKEY (R. L.) & WAKSMAN (S. A.). **Fungi tolerant to extreme acidity and high concentrations of copper sulphate.**—Abs. in *J. Bact.*, xlv, 2, p. 196, 1943.

From acid solutions (P_H 0·2 to 0·7) containing 4 per cent. copper sulphate were isolated two fungi, one of which was identified as *Acontium velatum* Morgan (a close relative of *Cephalosporium*), while the other, a dark green member of the Dematiaceae, could not be more closely determined in the absence of true spores. Both organisms throve in a synthetic medium with hydrogen-ion concentrations ranging from P_H 0·3 to 1, limited development being made even at 0·1 (0 in the case of the green fungus). The presence of copper sulphate in amounts sufficient to produce saturation of the medium did not impede the growth of the moulds within a range of P_H 0·3 to 2, a modicum of development also occurring at 0. The two fungi under observation are believed to show the greatest tolerance of the combined effects of high concentrations of copper sulphate and extreme acidity yet recorded.

LÖHNIS (MARIE P.). **Histology of symptoms of boron deficiency in plants.**—*Meded. LandbHoogesch. Wageningen*, xliv, 3, pp. 3–36, 1940. [Abs. in *Chem. Abstr.*, xxxvii, 8, p. 2043, 1943.]

The influence of boron deficiency on the anthers was studied from the histological standpoint in water cultures of wheat, oats, and barley. The sporogenous tissue was found to be particularly sensitive to the absence of boron. The primary injury appeared in the cell nucleus, where division was inhibited in the early stages of the shortage. At a later phase, however, cells of varying size and shape were formed. The normally high boron content of the pollen of the cereals tested is considered to explain the acute sensitiveness of the sporogenous tissues to the lack of this element.

In the swede, the first symptom of boron deficiency was the development of a wide zone of thin-walled cells from the cambium and phellogen. The initial damage to the cell walls was observed in the secondary vascular bundle, followed by the formation of thick-walled cells distinct from all the adjacent tissues. As in the case

of the cereals, the state of development at which the boron deficiency occurred determined the nature and extent of the trouble.

Chester (K. S.). **The nature and prevention of plant diseases.**—xii+584 pp., 196 figs., 7 diags., 4 graphs, Philadelphia, The Blakiston Company, 1942. $4.50.

The scope of this treatise and the mode of treatment of the subject-matter have been largely dictated by the needs of the author's students at the Oklahoma Agricultural Experiment Station, for whom an elementary course in plant pathology provides a fitting background for useful agricultural work. The dual purpose of the volume is to introduce the student to the essential features of the science, as exemplified in the major diseases of the leading United States crops, and to furnish him with a book of reference for detailed and specific directions on plant disease control. Emphasis is given to environmental factors, and to the conditions which give rise to epidemics. Following two introductory chapters on the significance of plant disease in agriculture and types of plant disease fungi, chapters 3, 4, and 5 deal with diseases caused by Basidiomycetes (rusts, smuts, fleshy fungi, mycorrhiza); 6, 7, and 8 with those induced by Ascomycetes, Fungi Imperfecti, and Phycomycetes; 9 is concerned with damping-off and related troubles and special attention is given to those diseases which are caused by pathogenic complexes; 10 and 11 with diseases caused by bacteria and viruses, respectively; 12 with those due to parasitic seed plants, algae, and epiphytes; 13 with nematode infestations; 14 with physiogenic diseases; 15, 16, and 17 treat, respectively, of the methods of studying plant diseases, environment and parasitic disease, and the etiology and epiphytology of disease; 18 discusses principles and procedures in the control of plant diseases and various aspects of the quarantine system; while 19 and 20 deal with control by inducing resistance and cultural methods, respectively.

Smith (R. E.). **Two items of pathological history from California.**—*Phytopathology*, xxxiii, 3, pp. 258–260, 1943.

Attention is drawn to two items of interest in the history of phytopathology antedating the first records given by Melhus and Kent in their recent text-book [*R.A.M.*, xix, p. 110]. Early volumes of *Trans. Calif. agric. Soc.* (beginning with the first in 1858) contain numerous references to the treatment of wheat seed-grain with copper sulphate against bunt [*Tilletia caries* and *T. foetida*], mention of which was also frequently made in *Calif. Culturist* (1858 to 1861). In the new manual 1873 is cited as the first year in which this method of control was applied.

Regarding peach leaf curl (*Taphrina deformans*), the authors of the recent treatise give 1883 as the earliest date mentioned in American literature on the disease, but it is described in various early books on fruit-growing, e.g., Downing's '*Fruits and Fruit Trees of America*' (1845) and was prevalent in California from the middle fifties onwards.

Went (F. W.). **Plant growth under controlled conditions. I. The air-conditioned greenhouses at the California Institute of Technology.**—*Amer. J. Bot.*, xxx, 2, pp. 157–163, 1 fig., 1 graph, 1 plan, 1943.

A full description is given of a set of air-conditioned greenhouses suitable for plant physiological work in which temperature and humidity can be kept constant or varied as desired. Two independent units, each consisting of a greenhouse and a dark room, are conditioned by two air-conditioning systems, and the plants, which are grown on movable tables, can thus be subjected to a wide range of conditions.

Drechsler (C.). **Another Hyphomycetous fungus parasitic on Pythium oospores.**—*Phytopathology*, xxxiii, 3, pp. 227–233, 1 fig., 1943.

A full description is given of *Trichothecium arrhenopum* n.sp., an active parasite

of *Pythium de Baryanum* in agar cultures to which small amounts of Wisconsin leaf mould have been added [cf. *R.A.M.*, xvii, p. 476]. The fungus is characterized by massive, crook-necked appressoria, 8 to 18 by 5 to 8 μ, by means of which it penetrates the oogonial envelope and oospore wall of its host. The conidiophores of *T. arrhenopum* are erect, hyaline, usually uniseptate, 25 to 50 (average 34·4) by 1·7 to 2·5 (2·2) and 0·7 to 1·5 (0·9) μ at the base and apex, respectively, and the conidia solitary, hyaline, clavate or elongate to elliptical, uniseptate, 17 to 25 (21·4) by 2·6 to 3·7 (3·1) μ.

Marsh (W. S.) & Duske (A. E.). **Mildew proofing military fabrics.**—*Text. World*, xcii, 8, pp. 58–60, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 8, p. 2189, 1943.]

Effective mildew resistance, persisting even after repeated washing, was conferred on military fabrics by treatment with a 1 in 2,000 solution of phenyl mercuric acetate, which did not impair the quality of the material and is both inexpensive and non-toxic.

Gandhi (R. C.) & Venkataraman (K.). **Mildew in Cotton. I. The routine examination of textile antiseptics. II. Estimation of salicylanilide in textiles. III. Synthetical experiments in antiseptics for textiles. Derivatives of Cashew-nut shell oil.**—*J. Indian chem. Soc.*, Industr. & News Ed., v, pp. 75–84, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 8, pp. 2188–2189, 1943.]

The action of antiseptics on cultures of *Aspergillus niger* was investigated by the method of Fargher *et al.* [*R.A.M.*, ix, p. 783], and the most promising compounds evaluated in a second test, in which cotton cloth treated with the various preparations was inoculated with the mould and placed in a moist atmosphere over mildewed water. The most active fungicides were para-chlorophenol, α- and β-naphthol, and salicylanilide and its derivatives.

The amount of the preservative shirlan (salicylanilide) present on a fabric can be estimated by a method based on the fact that the antiseptic will absorb approximately 3 mols. of bromide per mol.

None of the derivatives of cashew nut shell oil tested proved superior as mildew-preventives to those mentioned above.

Rosendahl (C. O.). **Some fossil fungi from Minnesota.**—*Bull. Torrey bot. Cl.*, lxx, 2, pp. 126–138, 19 figs., 1943.

A description is given of a fossil fungus obtained from three Pleistocene sites in Minnesota, and belonging to the same group as one described and figured by Butler which was found in glacial clays near Edmonton, Alberta [*R.A.M.*, xviii, p. 469]. The recent forms of the vesicular-arbuscular mycorrhizal fungus were referred to the genus *Rhizophagus*, but the fossil form from Alberta together with the Minnesota forms are assigned to a new fossil genus named *Rhizophagites*, characterized by terminal, ovate, short piriform, or subspherical, yellowish-brown to dark brown vesicles, measuring 46 to 124 by 42 to 103 μ, with walls considerably thicker than the walls of the mature hyphae, vesicles at first in open communication with the hyphae, later occluded by basal plugs or septa at the neck of the stalk or in the stalk or by a second wall forming round the contents; a second vesicle is sometimes formed within by proliferation from the stalk.

The Minnesota material agrees so closely with that from Alberta that it is almost certain that the same species is concerned. This is named *R. butleri* n.sp. while another species of the genus from the early Pleistocene strata in Minnesota is named *R. minnesotensis* n.sp.

BERTRAND (D.). **Importance de l'oligoélément vanadium pour l'Aspergillus niger.** [The importance of the trace element vanadium for *Aspergillus niger*.]—*C.R. Acad. Sci., Paris*, ccxiii, 6, pp. 254–257, 1 graph, 1941.

Added to cultures of *Aspergillus niger* on a synthetic liquid medium at a concentration of $4 \cdot 3 \times 10^{-9}$ gm. per l., vanadium increased the dry weight of the mould by 20·9 per cent. over that obtained in a control series in which the content of the trace element in the substratum was reduced by purification to less than 10^{-9} gm. per l. Hence it is concluded that vanadium, in such concentrations as are likely to be encountered by the fungus in nature, plays an important part in its physiological development, the minimum quantity necessary to produce the effect described being probably of the order of 2×10^{-9} gm. per l.

NICKERSON (W. J.) & THIMANN (K. V.). **The chemical control of conjugation in Zygosaccharomyces. II.**—*Amer. J. Bot.*, xxx, 2, pp. 94–101, 1 fig., 3 graphs, 1943.

Continuing their study of a conjugation-promoting principle from *Aspergillus niger* on *Zygosaccharomyces* [*R.A.M.*, xx, p. 590], the authors describe a simple method for determining within ±3 per cent. the number of cells conjugating in a given culture. The conjugation-promoting principle in the filtrate from old cultures of *A. niger* was found to be organic and to consist of at least two fractions, neither of which is very active by itself. One has the properties of an organic acid, while the other appears to belong to the vitamin B complex. The effect of the principle can be reproduced by a mixture of riboflavin and glutaric acid.

BURKHOLDER (P. R.). **Vitamin deficiencies in yeasts.**—*Amer. J. Bot.*, xxx, 3, pp. 206–211, 1 fig., 1 graph, 1943.

In this paper the author describes studies carried out on the growth factor requirements of 38 species and strains of yeasts cultured in a chemically defined medium with varied supplements of vitamins and liver extract. The treatments used were (1) without vitamins, (2) without thiamin, (3) without riboflavin, (4) without pantothein, (5) without niacin, (6) without biotin, (7) without inositol, (8) without pyridoxin, (9) with all seven vitamins, and (10) with all seven vitamins plus liver.

Under the experimental conditions 15 yeasts showed marked requirements for thiamin, none needed riboflavin, 14 required pantothenic acid, 6 nicotinic acid, 36 biotin, 4 inositol, and 6 pyridoxin. In all cases growth was increased by the addition of liver extract. The figures for *Candida albicans* may be cited (turbidity units of cultures grown for 72 hours at 25° C.); they were (for the 10 treatments listed above) 15, 61, 124, 126, 126, 6, 129, 125, 115, and 187, respectively. Some of the organisms may be useful in microbiological assays for vitamins.

MCKEEN (C. D.). **A study of some factors affecting the pathogenicity of Verticillium albo-atrum R. & B.**—*Canad. J. Res.*, Sect. C, xxi, 3, pp. 95–117, 9 graphs, 1943.

Following an epidemic of *Verticillium* wilt in the Niagara Peninsula, Ontario, in 1940, isolates of the causal fungus from diseased barberry, peach, rose, potato, eggplant, muskmelon, and chrysanthemum plants, although found to differ slightly in morphology and pathogenicity, were all referred to *V. albo-atrum*. In greenhouse experiments, the temperature range of heavy disease incidence at the optimum level of soil moisture was from 21° to 27° C. with a sharp peak at 24°, which coincides with the optimum temperature for vegetative growth of the fungus in culture; at high levels of soil moisture, the curve for heavy disease incidence was much broader, from 18° to 29°, and the symptoms appeared slightly sooner. A considerable residual inoculum was found to be still present in the soil in May, 1941,

following the 1940 epidemic. The fungus was shown to persist and to remain aggressive after three months in fine sandy and medium and red clay loam soils, both under cropped and fallow conditions, except when the soil was fallow and dry during the period. The growing of an immune or a susceptible host in infested soils for three months had no noticeable effect upon the survival of the fungus. Inoculum in a resting condition was found incapable of infecting plants unless incorporated in moist soil a few days earlier. The addition of green plant residue or of tartaric or citric acid to the soil slightly lowered the activity of the fungus.

An examination of phenological data during May, June, July, and August for the four years, 1939 to 1942, showed that soil temperatures high enough to permit disease development are not commonly encountered locally before late June, and that for the disease to assume serious proportions high soil moisture must be maintained uniformly during May, June, and July. It is suggested that the relative infrequency of *Verticillium* wilt epidemics on the Niagara Peninsula is probably due to the fact that soil moisture is usually low during that part of the growing season when soil temperatures are high enough to favour the development of the fungus.

Silberschmidt (K.), Nobrega (N. R.), & Kramer (M.). **Sobre as variantes do virus X das Batatinhas no Estado de São Paulo.** [On the variants of the X virus of Potatoes in the State of São Paulo.]—*Arq. Inst. biol., S. Paulo,* xii, 3, pp. 28–58, 6 pl., 1941. [German summary.]

Seven collections of potato virus X from different parts of the State of São Paulo, Brazil, were compared with each other and with isolates from the United States and Holland by the inoculation of White Burley tobacco, *Nicotiana rustica, Datura stramonium,* and other Solanaceous plants. In the light of their exhaustive inoculation experiments—the results of which are fully described and tabulated—the authors divide their nine isolates into two groups, one 'strong' and characterized by the necrotic type of symptom, comprising Ca 193/A5 and Ca 53/1 (two undetermined Dutch varieties from Cascata, São Paulo), Majestic (from U.S.A.), and Eigenheimer 1223, and the other 'weak', represented by Green Mountain, St. T. (an undetermined variety from Cantareira), Eigenheimer O.S., Ind. 401 (an undetermined variety from Indaiatuba), and Eersteling [Duke of York] (from Holland), of which the two last-named are very unstable, the predominantly chlorotic symptoms characteristic of the weak group occasionally alternating with a restricted production of definite necrosis. The members of the former group are taken to be variants of Salaman's X^S [*R.A.M.*, xviii, p. 130], while X^L is considered to be the prototype of those constituting the latter.

Bald (J. G.). **The effect of Potato virus X on growth and yield.**—*Aust. J. Sci.,* iv, 6, pp. 177–178, 1942.

Measurements in the field of the leaf area of mature Great Scot potato plants, half of which were virus-free and half infected with a masked strain of potato virus X, showed no difference between the healthy and affected plants. In a field trial of 23 Up-to-Date tuber lines infected with naturally occurring mixtures of virus X, significant yield differences were found to be associated with severity of infection, but no association was observed between growth rate or leaf area at maturity and severity of infection.

To measure the severity of these mixtures quantitatively three greenhouse experiments were made. Inoculations were carried out with each mixture of virus X to *Datura stramonium* and the symptoms rated. In June and the March following measurements were made of the growth of the test plants for six to twelve days after the first appearance of the symptoms; the length of each leaf

was measured, and these lengths compared, on the assumption that the shapes of the leaves were about constant.

In the winter experiment growth was only about half that of the summer-grown plants, symptoms were conspicuous, and there were wide and significant differences in growth between plants infected with different X virus mixtures. In the summer experiment symptoms were rather milder, and the effect of infection on growth was non-existent or small.

In the summer experiment light intensity and temperatures were high, and the conditions favoured rapid photosynthesis and gaseous exchange. The limiting conditions were probably (at least in the pots containing more than two plants) the intake of food materials by the roots or the numbers of respiratory centres in the cytoplasm. In these conditions virus X produced little or no effect on growth. In the winter photosynthesis and gaseous exchange were probably limiting factors, and virus X had its greatest effect on growth. Such results would follow if virus multiplication were a partial substitute for the synthesis of chromo- or chlorophyll protein, and if these portions were stored up beyond the minimum requirements for photosynthesis as inert reserve material.

In potatoes growing in the field near Canberra infection with virus X does not result in mosaic symptoms, and there is probably no loss of chlorophyll or photosynthetic efficiency. Light and temperature are high, lack of moisture and soil fertility being the chief factors limiting growth. Loss in yield may be due merely to the 'freezing' of some of the protein reserves in the form of virus protein, and the inability of the plant to reconvert the virus into substances capable of being translocated and stored in the tuber. Yield differences resulting from infection with milder and more severe strains would then result from the ability of the severe strains to multiply to greater concentrations in the plant than the mild strains.

KIRKPATRICK (H. C.) & BLODGETT (F. M.). **Yield losses caused by leaf roll of Potatoes.**—*Amer. Potato J.*, xx, 3, pp. 53–56, 1943.

The results obtained from a further application of Blodgett's method of determining potato leaf-roll losses [*R.A.M.*, xxi, p. 159] to the Chippewa, Cobbler, and Green Mountain varieties in four counties of New York State in 1942 confirm the view already expressed, i.e., that the healthy hills, adjoined by diseased plants on one side or both, partially compensate for the low yield of the leaf-roll plants. The gain in yield of a healthy plant with a diseased neighbour on both sides is approximately double that of a comparable plant with a leaf-roll plant on one side only. Thus, healthy plants with leaf roll on both sides averaged 16·8 per cent. higher yield than did healthy plants surrounded by healthy ones. Healthy plants with leaf roll on one side only gained 7·9 per cent. The average gains in yield for diseased plants competing with leaf roll on one side (4·2 per cent.) or both (8·1), compared with those having sound plants on each side, were only about half as large as in the case of healthy plants.

HENDRICKX (F. L.). **Le mildiou de la Pomme de Terre.** [Potato mildew.]—*Centre afr.*, xi, 488, p. 3, 1943.

Phytophthora infestans has now been definitely identified on potatoes from Rutshuru and Ruhengeri, Belgian Congo, and has also made its appearance in the neighbouring district of Kigezi, Uganda [cf. *R.A.M.*, xxi, p. 426]. Under the conditions prevailing locally the only possible means of control would appear to be the selection of resistant varieties, some suggestions for which are made.

Bouriquet (G.). **Contribution à l'étude des altérations de la Vanille préparée (moisissures et mite).** [A contribution to the study of alterations in processed Vanilla (moulds and a mite).]—*Bull. Acad. malgache*, N.S., xxiv, pp. 65–77, 4 col. pl., 1 fig., 1941.

Complaints having been received, notably from the United States (the largest purchaser), regarding the spoilage of the processed vanilla exported annually in substantial quantities from Madagascar, the author undertook an inquiry into the nature of the trouble and the factors contributing to its development. The following moulds were isolated on various nutrient media from samples from the east coast of the Island: *Aspergillus niger*, *Penicillium lividum*, *P. vanillae* n.sp., and *P. rugulosum*. *P. vanillae* [of which no Latin diagnosis is given] is characterized by pink colonies shading into various tones of orange, red, blue-green, and transitional tints according to the medium, the optimum temperature for growth ranging from 27° to 38·5° C. On glucose agar the conidiophores measure 3 μ in diameter, the metulae, commonly occurring in groups of three, 12 by 2·5 μ, the sterigmata, also frequently triple, 14 by 2·2 μ, and the rugose conidia 2·5 to 3 by 1·75 to 2·5 μ. Pink coremia are formed on haricot bean decoction agar on the sixth day. Gelatine was not liquefied after 80 days.

Mould damage was most prevalent at the base of the fruits, near the point of attachment to the peduncle, a site comparatively poor in vanillin, and also on fruits plucked before maturity, in which this substance (the monomethylic ether of the protocatechuic aldehyde) is not yet fully accumulated. In germination tests with a 1·5 per cent. glucose solution, plus 0·5 or 1 per cent. vanillin, *P. rugulosum* proved to be the most sensitive of the four organisms, but the growth of all was checked by a 1 per cent. concentration of vanillin in four days.

Cross (W. E.). **Variedades de Caña importadas. Resultados obtenidos en los últimos años.** [Imported Cane varieties. Results obtained of recent years.]—*Rev. industr. agríc. Tucumán*, xxxii, 7–9, pp. 193–271, 1942.

Among the attributes included in this tabulated account of the behaviour under Tucumán (Argentine) conditions of a number of imported sugar-cane varieties are their reactions to certain diseases, including mosaic and smut [*Ustilago scitaminea*].

Cross (W. E.). **Nuevas observaciones sobre el 'carbon' en las distintas variedades de Caña de Azúcar.** [New observations on 'smut' in individual Sugar-cane varieties.]—*Bol. Estac. exp. agric. Tucumán* 39, 15 pp., 1943.

Discussing the practical applications of further observations on varietal reaction to sugar-cane smut [*Ustilago scitaminea*] in Tucumán [*R.A.M.*, xxii, p. 197], the writer advises the ultimate replacement of the susceptible P.O.J. 36 and its mutants by such virtually immune types as Co. 270, Co. 290, Kavangire, P.O.J. 2725, P.O.J. 2878, Tuc. 1406, and Tuc. 2645. However, the process of substitution must of necessity be carried out step by step, since the supplies of resistant material are still limited, and moreover, not every immune or quasi-immune variety will be suited to all peculiarities of climate: it would be useless, for instance, to plant a delicate cane, however resistant to *U. scitaminea*, in a region subject to intense cold. Pending the completion of the exchange of susceptible for resistant varieties, it may be possible to make use of a number of widely grown sorts which are less severely attacked than P.O.J. 36, e.g., C[anal] P[oint] 29/320, P.O.J. 213, Tuc. 407, Tuc. 472, and Tuc. 1376.

Stevenson (G. C.). **The present and potential value of Sugar-Cane breeding.**—*Emp. J. exp. Agric.*, xi, 41, pp. 38–48, 1943.

The subject of sugar-cane breeding is discussed under three aspects, namely, the development of the enterprise since its inception in Mauritius in 1891, some of the problems confronting the breeder, and the trends of present-day research in the

accomplishment of varietal improvement. In the last-named connexion mention is made of the discovery that the genes responsible for immunity from mosaic and sereh disease are carried by the chromosomes of *Saccharum spontaneum*. Kassoer, a natural hybrid of this wild species, is immune, and in successive 'nobilizations' of its 'blood-line', P.O.J. 2364, with 28 *spontaneum* chromosomes, is immune, P.O.J. 2878, with about 14 *spontaneum* chromosomes, is sufficiently resistant for commercial purposes, while seedlings of the fourth 'nobilization', with approximately seven chromosomes, are more susceptible to the two diseases in question, though individual variations occur in this respect. These data denote that, in this case, disease resistance behaves as a polygenic character correlated with the number of *spontaneum* chromosomes present.

Another less familiar 'nobilization' series is the Uba-Marot 'blood-line', originating in the 64-chromosome Indian *S. spontaneum*, in which immunity from gumming disease [*Xanthomonas vasculorum*] is associated with the *spontaneum* chromosomes.

Sparrow (F. K.). **Aquatic Phycomycetes exclusive of the Saprolegniaceae and Pythium.**—xix+785 pp., 1 pl., 69 figs., Ann Arbor, University of Michigan Press, London, Humphrey Milford, Oxford University Press, 1943. $5.00.

In this volume the author is concerned primarily with the groups of Phycomycetes (exclusive of the Saprolegniaceae and *Pythium*, authoritative monographs of which are already available) inhabiting fresh and marine waters [*R.A.M.*, xv, p. 670], although no absolutely hard-and-fast rule can be drawn between the different families on the basis of their aquatic or terrestrial habitats [ibid., xxi, p. 472]. Owing to the scarcity of herbarium specimens of the group under consideration, and the inadequacy of the data obtainable from the few that do exist, most of the studies for the present monograph were carried out in the laboratory on living material. The annotated taxonomic treatment of the groups is in the main conservative, and no species has been relegated to synonymy where any doubt as to its validity remains. Geographical citations have presented some difficulty due to the changing political situation, and readers are warned that for the purposes of the treatise Austria and Czechoslovakia are included under 'Germany'.

Following an introduction dealing with the phylogeny and relationships, occurrence and geographical distribution, collection, isolation and culture, and preservation of the aquatic Phycomycetes, and supplemented by a key to the orders, the inoperculate and operculate Chytridiales, the Blastocladiales, Monoblepharidales, Plasmodiophorales [ibid., xxii, p. 40], Saprolegniales (Ectrogellaceae and Thraustochytriaceae), Leptomitales, Lagenidiales, and Peronosporales are described in detail and critically discussed. Each species is provided with the original citation, when known, and sometimes with excellent figures. Lists of substrata and synonyms and a 44-page bibliography are appended. This monumental work may be expected to become standard for many years and forms a valuable addition to the literature of the group.

Wei (C. T.) & Hwang (H. S.). **A checklist of fungi deposited in the mycological herbarium of the University of Nanking, I, (1924–1937).**—*Nanking J.*, ix, 1–2, pp. 329–372, [? 1942].

Rusts and powdery mildews comprise the majority of the 149 specimens of fungi collected in China from 1924 to 1937 and deposited in the mycological herbarium of the University of Nanking.

Bessey (E. A.). **Notes on Hawaiian fungi.**—*Pap. Mich. Acad. Sci.*, xxviii (*1942*), Part I, pp. 3–8, 1943.

In these notes the author briefly reviews and discusses the relative prevalence of the different fungi reported from Hawaii.

LOWE (J. L.). **The Polyporaceae of New York State (except Poria).**—*Bull. N.Y. St. Coll. For.* 60, 128 pp., 2 pl., 1942.

Included in this critically annotated list of 141 Polyporaceae (exclusive of *Poria*) occurring within the State of New York or close to its borders is a new combination, *Polyporus lowei* (Pilát) comb. nov. (*P. trabeus*) on spruce. The manual is furnished with keys to the genera and species and a glossary.

RICK (J.). **O género Polystictus no Rio Grande do Sul.** [The genus *Polystictus* in Rio Grande do Sul.]—*An. Reun. sul-amer. Bot., 1938*, ii, pp. 251–270, 1940. [Received May, 1943.]

This is a critically annotated list of 55 pedunculate species and 20 varieties of *Polystictus* collected by the author in the State of Rio Grande do Sul, Brazil.

RICK (J.). **Poliporos riograndenses.** [Polypores of the Rio Grande.]—*An. Reun. sul-amer. Bot., 1938*, ii, pp. 271–307, 1940. [Received May, 1943.]

Technical descriptions, supplemented by other points of interest, are given of over 130 species and nearly 40 varieties of Polyporaceae collected by the writer in the State of Rio Grande do Sul, Brazil [*R.A.M.*, xvii, p. 629].

TORREND (C.). **As Poliporaceas da Bahia e Estados limitrofes.** [The Polyporaceae of Bahia and the bordering States.]—*An. Reun. sul-amer. Bot., 1938*, ii, pp. 325–341, 1940. [French summary. Received May, 1943.]

This is a list, amplified by brief critical observations, of about 200 Polyporaceae collected by the author in Bahia and other regions of northern Brazil.

WYND (F. L.). **Respiration of mosaic-infected Tobacco plants.**—*Plant Physiol.*, xviii, 1, pp. 90–98, 1 graph, 1943.

Studies on the respiratory rates of healthy and mosaic-affected tobacco leaves [cf. *R.A.M.*, xxi, p. 307] showed that the rate of oxygen use by leaves from diseased plants was greatly increased by the fourth day following the inoculation of a lower leaf. This period of increased oxygen use preceded the general appearance of the virus in infectious concentration by about ten days. While the disturbed metabolism shown by the enhanced rate of oxygen use occurred in all parts of the plant simultaneously, the appearance of infectious concentration of new virus material occurred first in the upper leaves, which had a higher initial rate of metabolism. When infectious concentrations of virus appeared in the upper leaves, the rates of oxygen use by these leaves were always less than those of normal leaves. It is considered probable that the metabolic changes observed are cellular, and independent of any metabolic activity of the virus material.

VALLEAU (W. D.) & JOHNSON (E. M.). **An outbreak of Plantago virus in Burley Tobacco.**—*Phytopathology*, xxxiii, 3, pp. 210–219, 2 figs., 1943.

An outbreak of a necrotic virus disease in Burley tobacco near Lexington, Kentucky, in 1941 was found to be caused by the presence in the Ky. 36–12 Burley variety of the rib-grass (*Plantago major*) strain of the tobacco mosaic virus [*R.A.M.*, xxii, p. 44], the symptoms associated with which included marked stunting, long, depressed, dark streaks on the stalks, discoloured, sometimes concentrically patterned areas in the pith, and yellow, later necrotic, blotches on the leaves. Inoculations from the affected plants to Ky. 16 Burley and Turkish resulted in the development of mottling rather than typical necrosis. Both types of infection were observed in spontaneously diseased plants and are considered to be due to the same virus, the divergent reactions to which in different varieties are dictated by the presence or absence of the N^1 factor from *Nicotiana glutinosa*. None of the 14 strains of the tobacco mosaic virus from tobacco became systemically established in the *P. major* plants to which they were transferred.

Both June Pink and Marglobe tomatoes proved to be resistant to the rib-grass strain, their response to which was comparable to that of Ambalema Burley hybrids to the tobacco mosaic virus [ibid., xx, p. 499 *et passim*], but systemic infection developed in heavily inoculated, young, vigorous plants.

Field observations suggest that the existence of the rib-grass virus may have antedated the development of cultivated tobacco, in which case the numerous strains of the tobacco mosaic virus now recognized were presumably derived by mutation from the infective principle of *P. major*.

ESAU (KATHERINE). **Inclusions in guard cells of Tobacco affected with mosaic.**—*Hilgardia*, xiii, 8, pp. 428–430, 2 pl., 1941.

In the present study inclusions characteristic of tobacco mosaic, namely amoeboid, vacuolated X-bodies and striated material, were found to occur in the guard cells of stomata of tobacco plants. It was also demonstrated that the guard cells and the adjacent epidermal cells are connected with each other by plasmodesmata, but it remains an open question for the present whether plasmodesmata are necessary for the entry of the virus into guard cells.

ESAU (KATHERINE). **Phloem anatomy of Tobacco affected with curly top and mosaic.**—*Hilgardia*, xiii, 8, pp. 437–470, 18 pl., 6 figs., 1 diag., 1941.

The degenerative changes induced in the phloem of tobacco plants by the virus of curly top were found to be similar to those encountered in sugar beet [*R.A.M.*, xvi, p. 294]. In the apices of shoots and roots degeneration sets in as soon as the first sieve-tubes differentiate, appearing first in cells nearest to the sieve-tubes and sometimes, in root tips, in the differentiating sieve-cells themselves. This is rapidly followed by hyperplastic divisions leading to the formation of numerous short sieve-tubes. The difference between the hyperplastic and the normal tissues as regards cell pattern and the proportion of sieve-tubes is more striking in the primary than in the secondary phloem, although in the latter many ray cells differentiate into sieve-tubes and the phloem mother cells divide excessively.

The hyperplastic tissue disintegrates, particularly in the primary phloem, usually leaving cavities behind, although in less severe infections the collapsed hyperplastic tissue is replaced by new cells derived from the adjacent living cells. In tobacco plants recovering from curly top phloem degeneration is commonly present, even in organs showing no external symptoms, but is comparatively mild and of unequal severity in different parts of the same organ. The increased production of sieve-tubes almost invariably occurs even when the disease is most mild. The external symptoms of curly top appear on leaves most closely connected with the inoculated leaf by vascular tissue, thus confirming the conclusion that the virus is largely localized in the phloem.

In experiments with tomato plants the same degenerative changes were observed as in the tobacco and the sugar beet, the increased production of sieve-tubes being particularly striking. Owing to the larger size of their phloem cells the tobacco and the tomato are, it is suggested, more suitable for the study of hyperplastic sieve-tubes than is the sugar beet. The hyperplastic sieve-tubes are not essentially dissimilar from normal ones but usually lack companion cells.

The phloem of tobacco plants inoculated with the mosaic virus contained inclusion bodies typical of this disease, but no other abnormality.

SILBERSCHMIDT (K.) & CAMPOS (A. R.). **Novos aspêtos do problema da formação dos cristais em folhas de Fumo atacadas pelo mosaico.** [New aspects of the problem of crystal formation in the leaves of mosaic-infected Tobacco.]—*Arq. Inst. biol., S. Paulo*, xii, 4, pp. 59–74, 5 pl., 1941. [German summary.]

In further studies on the crystalline inclusions in the cells of mosaic-diseased

tobacco leaves [*R.A.M.*, xviii, p. 633], the writers devised a method for the continuous examination of the same cells of a living leaf without interrupting its connexion with the plant. The technique consists essentially in the protection of the hair cells in the selected marginal area by a glass chamber constructed of three circular cover slips joined together by cement. As soon as this is in place, a general drawing is made, under a low magnification, of the zone under observation, each hair being individually numbered to facilitate its subsequent location. The cells are then examined at daily intervals under a high power and all changes in their contents carefully recorded.

The first crystals appeared in the hair cells of young Geudertheimer tobacco leaves on the eighth day following inoculation by rubbing with juice from diseased plants, while in somewhat older ones a longer period (15 days) was required for the development of the inclusions, which were not formed at all in the oldest foliage. In leaves detached from the plant and placed with their petioles in a nutrient solution, under which conditions they remained alive for several weeks, the crystalline inclusions were first detected after six days.

Colquhoun (T. T.). **Spray trial to control spotted wilt of Tomatoes.**—*J. Aust. Inst. agric. Sci.*, viii, 4, pp. 171–172, 1942.

In an experiment carried out in South Australia on the control of tomato spotted wilt by spraying with tartar emetic [*R.A.M.*, xxi, p. 115], plants of the South Australian Dwarf Red variety were sprayed (*a*) in the seed-bed only, (*b*) after planting out in the field only, and (*c*) both in the seed-bed and the field with a mixture of 1 gm. tartar emetic and 2 gm. white sugar per 1 l. water. The seedlings were raised in plots in an unheated greenhouse, and half were sprayed every second day from the time the cotyledons expanded. Six weeks after sowing the seedlings were placed outdoors for nine days; they were set out in the field on 9th October, 1941. Field spraying was started a day later, and was continued twice weekly until 6th March, 1942.

The plants sprayed in the field and in the seedling stage showed 31·7 per cent. spotted wilt, those only in the field 29·2 per cent., and those only in the seedling stage 49·2 per cent., while the unsprayed controls showed 59·2 per cent. spotted wilt. Taking all the sprayed plots together, there were 38·8 per cent. diseased fruits, while in the unsprayed there were 55·3 per cent., and in other unsprayed plots of similar size, outside the experiment, 71·1 per cent., the corresponding figures for weights of diseased fruits per cent. of total weights of crops being 35·7, 48·6, and 68·3 per cent. These figures show a highly significant difference between the three series of plots both in number and weight of infected fruit. They also indicate that the effect of the spraying exerted some beneficial influence on the contiguous unsprayed plots. As, however, the sprayed plots had about 30 per cent. disease, it may be questioned whether the treatment did in fact give control.

Gottlieb (D.). **The presence of a toxin in Tomato wilt.**—*Phytopathology*, xxxiii, 2, pp. 126–135, 2 figs., 2 diags., 1 graph, 1943.

Using centrifuge tubes adapted from those described by Hamm *et al.* for the spectrographic analysis of stem tracheal fluids (*Proc. Soc. exp. Biol., N.Y.*, xlvi, pp. 347–351, 1941), the writer collected the vascular fluids of Bonny Best tomato plants inoculated with *Fusarium bulbigenum* var. *lycopersici* and found that they contained a toxin [*R.A.M.*, xv, p. 406 *et passim*] capable of inducing wilt in seedlings placed in the extracts. No toxins were present in plants affected by physiological wilting due to an insufficiency of soil moisture.

Wellman (F. L.). **Increase of pathogenicity in Tomato-wilt Fusarium.**—*Phytopathology*, xxxiii, 3, pp. 175–193, 2 figs., 1943.

The great majority of the saltants in agar cultures of the tomato wilt fungus (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xxi, p. 393] exhibited a lower order of virulence than the parents, the occasional variations in the reverse direction of pathogenicity representing less than one sector in a thousand.

The thermal death point of conidia from a virulent isolate of the organism was about 60° C., compared with just above 50° for a mild. In 2- to 2½-year-old cultures conidial germination was more abundant from virulent than from mild isolates. Cultures from surviving conidia from old cultures of mild strains of the wilt pathogen were usually more toxic to the host than those from conidia that had not been allowed to age. On agar surfaces the mildly pathogenic form of *F. bulbigenum* var. *lycopersici* outgrew the virulent, but in mixtures of the two types in Tochinai's liquid medium, the reverse was commonly the case.

Susceptible Bonny Best tomatoes inoculated with a mild strain of the pathogen were ordinarily invaded only up to the cotyledonary node, but when isolates of both types were used as inoculum, the mild one proceeded parallel with the virulent into the upper parts of the plant, though the subsequent development of the latter was more extensive than that of the former. In the resistant Marglobe only the basal parts of the plants were involved to any appreciable degree, even in the case of mixed infections. Where progression towards the plant apex did occur, the virulent strain tended to predominate over the mild. The changes in virulence under discussion are concluded to partake of the nature of adaptive variation rather than genuine mutation.

Green (D. E.) & Ashworth (D[orothy]). **Blight of outdoor Tomatoes—spraying tests, 1942.**—*J. R. hort. Soc.*, lxviii, 6, pp. 179–183, 1943.

Particulars are given of preliminary spraying experiments to determine the relative value of seven fungicides for the control of outdoor tomato blight (*Phytophthora infestans*) at the Royal Horticultural Society's Garden, Wisley, Surrey, in 1942, when up to five applications were given between 20th July and 16th September. The best results were given by two copper-containing proprietary mixtures, designated C and D, followed by Bordeaux and Burgundy mixtures (4–6–40 and 4–5–40, respectively), plus saponin, and proprietary spray B, A being less effective and lime-sulphur (1 in 60) useless for the object in view. Burgundy mixture caused very slight foliar scorch and formed a bluish deposit on the fruits, the latter blemish being more conspicuous following treatment with Bordeaux, while lime-sulphur was responsible for severe injury in the form of white spots and blotches. One correctly timed treatment (first half of August) would appear to suffice for the control of the disease in south-eastern England.

Skok (J.). **Defoliation of Tomato plant as a response to gaseous emanations from the fruit.**—*Bot. Gaz.*, civ, 3, pp. 486–489, 1943.

In the eastern and mid-western tomato-growing areas of the United States defoliation of tomato plants during the latter part of the season is a major problem. As a rule it becomes noticeable as the fruits begin to ripen, and it progresses rapidly as larger amounts of fruit are produced. The process generally starts with shedding of the leaves nearest the crown in close proximity to the fruits that have ripened earliest. It proceeds progressively towards the terminal ends of the branches as subsequent clusters of fruit ripen. Finally, only the leaves at the tips of the branches are left.

Fields almost denuded of green leaves frequently become green again owing to new shoot growth in the axils of the leaf scars on the old vines. By such time most of the fruits have decayed or withered, and new growth, weather permitting,

appears to be possible as soon as they have been removed. Vines which fail to produce new shoots have ripe fruits on or near them. Plants in home gardens where the fruits are removed as soon as ripe, show less defoliation than those in commercial fields, where large numbers of over-ripe fruits are allowed to accumulate.

Experiments were made to test the view that the defoliation was associated with gaseous emanations from ripe fruits. Young potted tomato plants placed in glass chambers with ripe tomato fruits showed very severe epinasty after 18 hours. After two days a number of the lower leaves abscissed, on the fourth day only the top leaves remained (and these showed conspicuous epinasty), and on the sixth day most of the plants were dead. Controls in similar chambers without ripe fruits were unaffected.

Late in August young potted tomato plants were transplanted at random in a field of tomatoes which were in full bearing and showed marked defoliation. The young plants were planted near the old ones, in such a manner that ripe fruits were immediately beneath them. After four days the young plants had become pale, and some of their leaves and leaflets were curled. On the fifth day the lower leaves were yellow and curled and the tips of several leaflets had become dry. A day or two later all the lower leaves died, while the upper ones were curled and had dried tips and edges. Some of the older leaves had abscissed, but in most cases the blades were dry, and the petioles remained attached, abscissing later. After 15 or 16 days the remaining upper leaves regained colour and resumed growth; the fruits underneath these plants had by this time dried up. During the entire period control plants placed about 20 ft. away from the edge of the field remained normal.

In a third experiment ripe tomato fruits were placed under several plants (of two varieties) which had not previously become defoliated and from which the fruits had been regularly harvested shortly after turning red. Extreme defoliation resulted, though control plants under which ripe fruits were not placed remained unaffected. Various nutrition experiments failed to demonstrate any relation between the condition and nutrition. The evidence suggests that the defoliation in question is probably due to gaseous emanations from ripe fruits present on the vines. Ethylene, it is considered, may be one of the principal compounds involved.

Mullison (W. R.). **Certain aspects of the nutrition of Tomato seedlings in sand culture.**—*Proc. Ind. Acad. Sci.*, li, pp. 94–99, 2 diags., 1 graph, 1942.

In sand culture studies on the nutrition of Marglobe tomato seedlings severe stunting resulted from heavy applications of phosphates when nitrates were absent or extremely deficient. Shortage of phosphorus was also characterized by stunting, accompanied by a purplish tinge originating along the veins on the under sides of the leaves. Slight stunting and chlorotic mottling of the foliage were signs of sulphur deficiency. Plants lacking a sufficiency of potassium showed marked dwarfing and a downward curling of the leaves, while the absence of calcium led to severe stunting and the death of the terminal meristem. Sodium was shown to be capable of greatly retarding or modifying the appearance of potassium-deficiency symptoms, while the presence of the former in addition to the latter element afforded a definite stimulus to the growth of the plants.

Roth (E. R.) & Hepting (G. H.). **Origin and development of Oak stump sprouts as affecting their likelihood to decay.**—*J. For.*, xli, 1, pp. 27–36, 1 fig., 1 graph, 1943.

The investigations fully described and tabulated in this five-year progress report on the origin and development of oak stump sprouts in relation to their susceptibility to decay [*R.A.M.*, xix, p. 245 and next abstracts] were carried out on two one-acre areas in western Virginia, in which the 55-year-old stands were cut in 1935 and 1936, leaving stumps about 12 in. high and 10 in. in diameter in one

stand and 7 in. in the other. Sprouts of basal origin were found to be least likely to contract infection, but only 30 per cent. of the dominant sprouts fell into this group; it is therefore advisable to eliminate at an early stage the highest sprout, which tends to become dominant and may produce a rotten crop tree, and to encourage the new growth formed on the lower part of the trunk. These measures will be most effective if taken when the stands are under 20 years old, preferably from 8 to 15.

An estimate of future butt rot in the study plots, based on the heights of origin of the dominant sprouts, indicates that some 32 per cent. of the trees alive at 40 years will be affected.

Roth (E. R.) & Hepting (G. H.). **Wounds and decay caused by removing large companion sprouts of Oaks.**—*J. For.*, xli, 3, pp. 190–195, 2 figs., 1943.

In 68 oaks of mixed species from which companion sprouts larger than 3 in. at the base had been cut 6 to 12 years earlier in the course of thinning operations, butt rot (*Stereum gausapatum*) [see preceding and next abstracts] had entered nine through the remaining stub or wound and a further five showed infections that had probably originated in this way. In 1935–6, companion sprouts were removed from 127 trees by (*a*) cutting flush with the remaining stem, (*b*) cutting off at 3 ft., and (*c*) girdling. At the end of five years 27 per cent. of the wounds from 1 to 2·5 in. wide and 5 per cent. of those measuring 2·6 to 4 in. were closed, while none of the larger ones had completely healed over. Most wounds were larger at the end of a year than when originally made on account of bark die-back, and those measuring 5·6 in. or more in width generally took four years to revert to their former size. About half the girdled trees and 3 ft. high stubs had died back to the crotch, where callus formation was in progress. Of the 19 per cent. of the wound surfaces harbouring decay fungi, only two bore heart-rotting organisms, one *S. gausapatum* and the other *Ustulina vulgaris*.

Roth (E. R.). **Effect of invisible decay on deterioration of untreated Oak ties and posts.**—*J. For.*, xli, 2, pp. 117–121, 1943.

Hypholoma sublateritium, *Stereum gausapatum* [see preceding abstract], an unidentified species of *Poria* emitting a smell of cabbage in culture, and *Polyporus* [*Polystictus*] *versicolor* were the fungi most commonly isolated at the end of five to six years from oak logs infected but showing no perceptible signs of decay when placed in position, one lot being partially buried in cinders and the other set in the ground to simulate railway sleepers and posts, respectively. It is estimated that such material would decay about a year earlier than that from sound trees. Little or no benefit was derived from eight months' seasoning of the logs.

Herrick (J. A.) & Alexopoulos (C. J.). **A further note on the nitrogen metabolism of Stereum gausapatum.**—*Ohio J. Sci.*, xlii, 3, pp. 109–112, 1942.

As already reported, synthetic media containing inorganic salts or asparagin as the sole source of nitrogen support little or no growth of *Stereum gausapatum* [*R.A.M.*, xix, p. 125], whereas a 1 per cent. peptone-containing substratum yielded abundant mycelium. The addition to media in which peptone, asparagin, or ammonium ions represented the only sources of nitrogen of minute amounts of thiamin (10^{-4} gm. per 50 c.c.) greatly increased growth, but the growth substance did not exert the same effect on substrata containing only nitrate ions. The fungus is therefore capable of utilizing asparagin and ammonium salts, as well as peptone, as sources of nitrogen, the thiamin content acting as the limiting factor.

Pady (S. M.). **Further notes on the witches' brooms and the substomatal pycnia of Melampsorella.**—*Proc. Kans. Acad. Sci.*, xliv, pp. 190–201, 13 figs., 1941.

Descriptions are given, accompanied by photographs, of witches' brooms

produced by *Melampsorella* on *Picea engelmanni* and *Abies lasiocarpa* in the Gothic region of Colorado. During the winter the brooms are dormant, but in June the leaves appear and almost immediately pycnidia are formed. Infected leaves are paler than normal. The aecidia develop slowly during July and August, maturing on *Picea* during the latter month and on *Abies* by the end of the former. The warm, dry summer of 1940 induced early maturity of the aecidia and death of many infested branches. On *P. engelmanni* the aecidia impart an orange-red colour to the brooms, forming a striking contrast to the dark green of the normal foliage. The excrescences are frequently situated at or near the top of the tree, some very close to the trunk and others at the end of a long branch. One of the largest brooms observed on this host measured over 6 by 2 to 3 ft. On *A. lasiocarpa* the roughly circular brooms are pale green and very compact, one of the best specimens being about 12 in. in diameter.

Exsiccata from the Arthur Herbarium of *Melampsorella* spp. on its aecidial hosts showed that on *Picea* spp. the pycnidia are all substomatal, while on *Abies* spp. they are subcuticular. The diameter of the mature pycnidia of the rust on *P.* spp. ranged from 86 to 140 μ, and the height had the same range, while the species on *A.* spp. measured 100 to 230 μ in diameter and 23 to 40 μ in height, with an average of 141 by 35 μ. The results are considered to indicate that two species of *Melampsorella* are involved, and not one, as Arthur thought.

LUTZ (L.). **Sur l'attaque du bois par les Hyménomycètes lignicoles. Cas du Daedalea quercina.** [On the infection of wood by lignicolous Hymenomycetes. The case of *Daedalea quercina*.]—*Boissiera*, vii, pp. 293–295, 1943.

During the period between 28th March, 1939, and 28th July, 1942, a sample of beech wood exposed to contact with a culture of *Daedalea quercina* from oak under controlled conditions of excessive humidity underwent conversion into a translucid mass. As in the case of *Coriolus* [*Polystictus*] *versicolor* on the same substratum [*R.A.M.*, x, p. 700], the process of disorganization was initiated by hydrolysis of the lignin component, followed by disintegration of the cellulose and ultimately of the middle lamella.

SENGUPTA (S. K.). **Spore-germination of Ganoderma lucidum (Leyss.) Karst.**—*Curr. Sci.*, xii, 2, pp. 59–60, 1943.

Spores of *Ganoderma lucidum* obtained from sporophores collected at Calcutta from September to November, 1942, germinated readily on a medium consisting of 2 per cent. malt extract, 2·5 per cent. agar, and 100 c.c. distilled water, P_H 6·8, at a temperature range of 20° to 32° C. and a relative humidity of 52 to 98 per cent. Under laboratory conditions the sporophores discharged spores for one to two days. Field observations over a number of years indicate that the spore fall in *G. lucidum* is usually profuse while the hymenial surface is moist and grey, lessening when the colour pales to white, and ceasing on the development of a brownish tinge. Writing personally from Singapore to S. R. Bose, who was successful in germinating the spores of the fungus in 1929 (*Bot. Gaz.*, lxxxvii, pp. 665–667), E. J. H. Corner states that the spores are ejected only from well-grown sporophores, with tubes 1 cm. or more in length, but in the author's specimens the tubes did not measure more than 2 to 3 mm.

BAXTER (D. V.). **Some resupinate Polypores from the region of the Great Lakes. xiv.**—*Pap. Mich. Acad. Sci.*, xxviii (*1942*), Part I, pp. 215–233, 6 pl., 1943.

In this further instalment of his critically annotated list of resupinate Polypores from the Great Lakes region of the United States [*R.A.M.*, xxi, p. 397] the author states that *Poria mutans* Peck is commonly distributed throughout the range of chestnut, frequently fruiting on the ends of old logs and in hollow butts. It is

associated with a pocket rot, and when fruiting bodies are found, the decay is often so far advanced that the logs attacked consist of concentric layers of reddish-brown, rotted wood, loosely held together. The type of decay associated with this fungus resembles that caused by *Polyporus croceus* [ibid., xi, p. 680]. The tubes of *P. mutans* are up to 6·5 mm. long, mostly about 4 mm., as compared with 5 to 20 mm. for *P. croceus*, which is also usually plicate.

Poria vulgaris has been confused in herbaria with *P. vaporaria*, partly because a number of different fungi are found under these names. The spores of the two species are similar, but in *P. vaporaria* the mouths of the tubes are mostly 1 to 2 per mm., while in *P. vulgaris* they are generally 4 to 5 per mm. Further, the mouths of *P. vaporaria* do not glisten. *P. vulgaris* is one of the commonest members of the resupinate polypores in Sweden, and occurs much more abundantly in northern Europe than in America. In Sweden it is usually found on old fences, but in the United States it rarely attacks structural timbers. Many different growth forms of *P. vulgaris* are stated to have received 'herbarium' names at European institutions.

Many field records erroneously attribute rot caused by *Trametes odorata* to *Lenzites sepiaria*, the result being that the fungus is in reality more prevalent than it appears to be from published accounts. Fungi generally found on conifers occasionally occur on hardwoods and there is an authentic record of *T. odorata* on an oak railway sleeper. Many of the wood-destroying fungi found on hardwoods can be cultured on coniferous wood, and vice versa.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 1, pp. 29–33, 5 figs., 1943.

Ring spot (*Mycosphaerella brassicicola*) of crucifers is widely prevalent in southern Victoria; it has greatly reduced the market value of cabbages during wet seasons in some of the heavier soils round Melbourne. It seldom causes any great loss of yield, but it detracts from the appearance of cabbages and cauliflowers. Most of the cabbage, cauliflower, and Brussels sprouts seed crops inspected during the past season were found to be infected, some severely, with a resultant reduction in seed yield. Growers should resort to hot-water seed treatment (30 minutes at 122° F. followed by 5 to 10 minutes in cold water).

Commercial growers and home gardeners who use their own pea seed are advised to examine their crops carefully for *Ascochyta* blight [*A. pisi*, *A. pinodella*, and *M. pinodes*: *R.A.M.*, xxi, p. 438] and *Septoria* leaf blotch (*S. pisi*), of which the former is the more serious.

Weather conditions were very favourable during the past season to the development of onion mildew (*Peronospora destructor*), which occurred in epidemic proportions in many parts of Victoria. Infection was particularly severe in metropolitan market gardens, where onions are planted too thickly. Onions should not be cultivated in low-lying areas sheltered by hedges or wind-breaks; ample spacing should be provided, infected refuse should be burnt, and rotation should be practised.

Jolivette (J. P.) & Walker (J. C.). **Effect of boron deficiency on the histology of garden Beet and Cabbage.**—*J. agric. Res.*, lxvi, 4, pp. 167–182, 10 pl., 1943.

A microscopic study of the histological changes occurring in garden beet [*R.A.M.*, xxii, p. 235] and cabbage [ibid., xx, p. 554] plants grown under conditions of boron deficiency in nutrient sand cultures in the greenhouse or in the field, was conducted in Wisconsin. In beet, it was found that the first signs of disease in the roots and hypocotyl of seedlings appear in the phloem cells (many of which are entirely or partly filled with a dense substance) and in occasional hypertrophy of cambial cells. In older beet plants primary and secondary xylem

cells were found to contain a brown deposit and occasionally to become distorted. Groups of disintegrated cells were frequently seen surrounded by proliferating ones, sometimes involving one or two bundles and thus giving rise to macroscopic necrotic areas. In roots subjected to acute boron deficiency at a somewhat later stage the most severe necrosis occurred in the tertiary ring or rings most active in differentiation at the time. In the leaves of young beet plants the most extensive degeneration was found in the vascular bundles of the petiole. Such abnormal development was seen commonly in old leaves which appeared normal outwardly, and in which it had occurred too late to influence gross morphology. The extent of histological changes in younger leaves was directly proportional to the severity of external symptoms. In petioles of unilaterally developed leaves the bundles on one side showed slight if any changes, while those on the other side were severely degenerated. Cell enlargement and proliferation extending to the mesophyll and spongy parenchyma was seen in the leaf lamina. Cell proliferation also occurred in the cambium and the pith of the floral axis. Necrotic areas were found in the pith and in the vascular region of secondary and tertiary rings, being sometimes connected with similar regions in the cortex, where the lesions occasionally involved epidermal cells.

In cabbage extensive proliferation of cells in the region of the cambium of root, hypocotyl, and stem of young plants resulted in a band of meristematic tissue several times the normal width of the undifferentiated zone between phloem and xylem. Accordingly, there was less differentiation, and subsequent necrotic development in the vessels and phloem elements. Occasional abnormalities were observed in the cortex of the stem apex, but necrosis in the pith was rare until the plant entered the heading stage. In the field boron deficiency symptoms were usually confined to this region. In the petiole and lamina the chief sign of disease was a disturbed differentiation of the vascular bundles.

In both beet and cabbage boron deficiency seems thus to affect chiefly the metabolic processes involved in cell division, differentiation, and possibly storage. The cells react at first by discoloration of the walls and contents, excessive division, and abnormal enlargement; later necrotic areas appear, consisting of disintegrated cells, which are frequently surrounded by a region of abnormally active hyperplastic, hypertrophied, and sometimes peculiarly differentiated cells. The pathological histology of black spot of garden beet and internal breakdown in the pith of cabbage was found to be the same in plants cultured in nutrient sand or grown in the field. In both beet and cabbage extensive histological changes were observed before the appearance of macroscopic symptoms.

YARWOOD (C. E.). **Onion downy mildew.**—*Hilgardia*, xiv, 11, pp. 595–691, 13 figs., 1943.

Onion mildew (*Peronospora destructor*) is stated to have a world-wide distribution. In California, where the present study was started in 1935, it is considered to be the most serious disease of the onion seed crop, causing losses up to 70 per cent. of the total crop and up to 100 per cent. in individual fields. Infection of the leaves appears to have little effect, but that of the seed stalks leads to reductions in yields of seed. The disease, previously recorded on onion, *Allium fistulosum*, *A. nigrum*, leek, *A. ursinum*, *A. oleraceum*, garlic, shallot (*A. ascalonicum*), and *A. schoenoprasum*, was observed by the author only on the first two species. All varieties of the common onion were found to be susceptible, though varying considerably in the amount of injury sustained. In systemic infections paling, down-curling, and narrowing of the leaves is typical; and in secondary infections from sporangia produced by primary infections, the large, oval, slightly chlorotic lesions on leaves and seed stalks are present; while the most characteristic symptom

is the greyish-violet, downy growth of sporangiophores covering infected leaf tissues.

The author uses the name *P. destructor*, with Berkeley as the sole authority [and not (Berk.) Caspary apud Berkeley], for the causal fungus of downy mildew, not accepting Wilson's (*Mycologia*, vi, pp. 192–210, 1914) and Cook's [*R.A.M.*, xii, p. 484] reasons for including Caspary as a second authority.

In culture the sporangia of the fungus failed to make continued growth on agar media to which various test nutrients were added. The most stimulatory of these test nutrients was potassium permanganate. On plates of agar, the germ-tube of the fungus grew at about 30 μ per hour.

Other fungi accompanying downy mildew on onions and causing serious losses, though all less important than *P. destructor*, were *Botrytis allii*, *Macrosporium* sp., and *B. cinerea*. Infection with *Macrosporium* was more frequent on the north than on the south side of onion seedstalks. In California mildew infection is believed to be carried over from one season to another chiefly by means of mycelium in the bulbs. Seed from heavily infected plants produced healthy plants in two tests. Sporulation of the fungus normally took place at night, the sporangia maturing in the early morning and being liberated throughout the day. The optimum relative humidity for sporulation was about 100 per cent., the minimum about 90 per cent.; the optimum temperature about 13° C., the minimum between 4° and 7°, and the maximum between 22° and 25°. At a low relative humidity sporangiophores were shorter than at a high humidity. It appeared from a series of tests that exposure of infected plants to light favoured subsequent sporulation in darkness, that during sporulation light was unfavourable to the process, and that the normal diurnal cycle of sporulation of the fungus in nature is in part an adaptation to the alternation of light and darkness in the normal day. Sporangia were found to be disseminated by the wind. They remained viable for about three days when attached to sporangiophores on living leaves, but for only about one day when detached and lying on the surface of healthy leaves. The germination of sporangia required the presence of free water, the germ-tube entering the host plant through the stomata. Germ-tubes were observed to penetrate beyond the area of inhibition by drying or eradicant sprays in about seven hours, and the mycelium grew at a rate of about 300 μ per hour in the leaf. In one test the infected tissues sporulated already five days after inoculation, but usually this interval was longer. Artificial infection was achieved by six different methods. Systemic infection of plants grown from bulbs was induced by injecting a spore suspension into the bulbs prior to planting. The epidemiological factors considered as critical under Californian conditions are, in order of importance: source of inoculum, temperature, moisture conditions, and wind. The disease may be severe in the absence of rain. Sporangia of the fungus germinated better on plain agar than in water, causing infection at temperatures from 1° to 28°, with an optimum at about 13°. Sporangiophores were formed at from 7° to 22°. The mycelium was killed by heating infected bulbs for four hours at 41° and by heating infected leaves for ten hours at 37°.

In spore-germination tests, peptone and asparagin were antagonistic to Bordeaux mixture; sulphur dust was toxic to sporangia on agar plates and on rubbed onion leaves, but not on glass slides or on normal onion foliage. Sulphur sprays inhibited sporulation more effectively than did copper sprays. Rosin lime-sulphur or malachite green sprays did not appear to kill the mycelium in the tissues but reduced the injury from infection. The addition of vegetable oils to various copper sprays increased their protective value. In field tests, under conditions of severe disease, all fungicidal sprays tested reduced the incidence of infection and increased yields by 60 to 5,700 per cent., possibly the best results being achieved with the rosin lime-sulphur mixture. Marked control was obtained with

applications of concentrated sprays in the form of vapour dusts, but dry-dust fungicides proved useless.

McNew (G. L.) & Sayre (C. B.). **The use of fungicides during war time. II. Effect of soil fertility on returns from use of fungicides.**—*Canner*, xcvi, 7, pp. 14–15, 42–44, 3 figs., 1 graph, 1943.

In April, 1942, Surprise pea seed both untreated and treated with spergon at the rate of 2 oz. per bush. was sown in unfertilized plots and plots receiving 600 lb. of 5–20–5 fertilizer per acre. In each of two tests the treated seed gave about 90 per cent. stand, while the untreated gave 76 per cent. in the first and 82 to 85 per cent. in the second. Soil fertility had no effect on seed decay, but it affected yield. In both tests, the smallest yield was given by untreated seed in unfertilized soil, and the largest from treated seed in fertilized soil. On the average, the two treatments nearly doubled the yield (raising it from 1,877 to 3,524 lb. per acre). Either treatment, used alone, increased yield by 700 to 1,100 lb. per acre, but the full value of each was realized only when both were used together. The same relationship was established by a test with Wisconsin Early Sweet peas in 1941.

John Baer tomato plants in plots each receiving one of nine fertilizer treatments were sprayed with copper oxychloride sulphate (4 lb. per 100 gals.), using nearly 200 gals. per acre in each of four applications between 20th July and 21st August; a similar series of plots was dusted four times with the same compound mixed with talc, so as to give 6 per cent. metallic copper, and a third series remained undusted and unsprayed. On 31st August, all the sprayed and dusted plots were given an application of Bordeaux mixture (4–2–50). A severe attack of *Macrosporium* [*Alternaria*] *solani* developed in August, and by 1st September the unsprayed plants had become heavily defoliated. The spray and dust both retarded infection very satisfactorily, but the dust was less effective than the spray.

Spraying and dusting generally increased the yield on the better fertilized plots by about 6 tons per acre, and by 3 tons on the poorer ones. The average increase from spraying in all nine fertilizer treatments was 5·36 tons and from dusting 4·6 tons. The yields show precisely the same relative results as the two pea tests. The poorest yield came from the unfertilized, unsprayed plot, and the heaviest from the sprayed plot given 3–12–12 special fertilizer. The combined effect of the two treatments was to increase yield from 7·6 to 24·3 tons per acre. The unsprayed, unfertilized plot gave a gross receipt of only $128 per acre, spraying increasing the value (partly through the improved grading that resulted) of a similar plot by about $88; the unsprayed, fertilized (3–12–12 special) plot realized $264 per acre, and spraying increased the value by nearly $200 per acre. These data demonstrate conclusively that only a mere fraction of the value of the fertilizer was realized when the plants were severely diseased, and that spraying was much more profitable on well-fertilized plants than on unfertilized ones.

McNew (G. L.). **The use of fungicides during the war. III. Value of different seed treatments for Lima Beans.**—*Canner*, xcvi, 8, pp. 14–17, 3 figs., 1943.

Lima beans [*Phaseolus lunatus*] of the Henderson Bush variety sown on 30th May, 1942, when conditions favoured seed decay, after treatment with yellow cuprocide (1 oz. per bush.), thiosan (1·5 oz.), spergon (3 oz.), no treatment, no treatment but seed inoculated with a humus culture of nodule bacteria, fermate (2 oz.), spergon (1·5 oz.), spergon (inoculated seed, 1·5 oz.), semesan jr. (1·5 oz.), and semesan jr. (inoculated seed, 1·5 oz.) showed, respectively, 29·8, 47·8, 53·6, 27·2, 26, 50·4, 49·4, 52·2, 35, and 38·8 per cent. emergence. The same relative results were obtained in tests carried out on 20th May and 4th and 11th June. The benefits from the best treatment (spergon 3 oz.) varied with severity of seed

decay; increase in emergence in the earliest experiment over the controls was ten-fold, in the second double, in the third 50 per cent., while in the last sowing (11th June) the untreated seed gave an equally good stand. The treatments also increased the yields in about the same ratio as they improved emergence. Spergon (3 oz.) increased the yield over the whole series of experiments by 33 per cent., and at 1½ oz. by 32 per cent.; fermate and thiosan gave increases of 29 and 26 per cent., respectively. The only material that failed to produce an increase was yellow cuprocide, which is toxic to Lima beans because it hardens the seed coat. In field tests under commercial conditions, generally confirmatory results were obtained.

It is concluded that the general treatment of Lima bean seed with spergon at about 2 oz. per bush. will prove profitable. Thiosan (1 or 1·5 oz.) and fermate (2·5 oz.) may be given limited tests by canners interested in seed treatment. An ounce of graphite should be added if the seed is sown by drills.

Parbery (N. H.). **The excessive uptake of manganese by Beans showing scald and magnesium deficiency. Its regulation by liming.**—*Agric. Gaz. N.S.W.*, liv, 1, pp. 14–17, 1 fig., 1943.

In further studies [cf. *R.A.M.*, xxi, p. 62] on 'scald' of dwarf French beans [*Phaseolus vulgaris* var. *nana*] in New South Wales, three soils, A, B (sandy loams), and C (a heavy loam), liable to produce affected crops were treated by the addition of slaked lime 3 tons, dolomite 4 tons, and sulphur 600 lb. per acre. After mixing, the soil was transferred to earthenware pots on 9th October, 1941, and wetted to field capacity. On 23rd March, 1942, the soil was given a complete fertilizer, seed from locally grown beans was sown, and the pots were placed out of doors.

On 30th May, the plants in soil A, untreated, were largely defoliated following scald, in lime- and dolomite-treated soil A they showed a normal green foliage, and in sulphur-treated they were defoliated. The yields of green pods per pot were, respectively, 21, 81, 67, and 5 gm. In soil B, similar results were obtained but in soil C, untreated, lime-treated, and dolomite-treated the foliage was normal, while in the sulphur treatment it was partially defoliated, following slight scald. The manganese content of beans in the untreated soils was high (A, 207, B, 262, C, 780 p.p.m.) but intensification of acidity by sulphur caused a greatly increased intake of this element (A, 530, B, 291, C, 1,340 p.p.m.). As in the field, plants with magnesium deficiency symptoms contained the most manganese. Lime and dolomite very effectively regulated manganese uptake (soil A, lime 38, dolomite 45 p.p.m., B, 36 and 32, C, 68 and 66 p.p.m.). Reduction of acidity had a much smaller effect on the uptake of iron, and this uptake was considerably greater in the pots than in the field, showing the mobility of iron even at reactions near neutrality.

The excessive uptake of manganese, iron, and, possibly, aluminium by bean plants liable to scald, as well as chlorosis due to magnesium deficiency, are varied expressions of mineral depletion of soils, giving rise to excessive acidity. In the former case, acidity has caused the mobilization of manganese and iron in excess of the amounts required for good growth, while the continuous loss of magnesium has been partly responsible for the slow increase in soil acidity. The use of dolomite against soil acidity is preferable where crops show magnesium deficiency. It provides lime and magnesium, and reduces acidity as effectively as the more active forms of lime, when used in chemically equivalent amounts, 3 lb. slaked lime approximating to 4 lb. dolomite.

Mounce (Irene) & Bosher (J. E.). **Seedling blight of Carrot caused by Alternaria radicina.**—*Sci. Agric.*, xxiii, 7, pp. 421–423, 1 fig., 1943.

In recent greenhouse tests of carrot seed in British Columbia most of the

seedling blight that occurred was due to *Alternaria radicina* [*R.A.M.*, xxi, p. 360], apparently not before reported as causing seedling blight in North America. During the last two years, 28 samples of carrot seed were grown in the greenhouse in steam-sterilized soil; in 1940, the 14 samples of seed produced were either uninfected or gave only a negligible amount of seedling blight, while in 1941, of 14 samples produced, only five were uninfected or almost so, six showed 14 to 18 per cent. seedling blight due to this fungus, one showed 22 per cent., one 27 per cent., and one 40 per cent. Weather conditions during the harvesting of the seed in 1941 had been highly unfavourable.

When cultures from infected seedlings were used as inoculum, typical black rot was produced in surface-sterilized carrot roots and typical seedling blight in healthy young seedlings.

Almost complete control was given by seed treatment with semesan jr. (1 per cent. ethyl mercury phosphate), new improved ceresan diluted to contain 1 per cent. ethyl mercury phosphate, or spergon (tetrachloroparabenziquinone).

Kreutzer (W. A.) & Glick (D. P.). **The role of packing methods in the increase of anthracnose of Honeydew Melon plants.**—*Phytopathology*, xxxiii, 3, pp. 245–248, 1943.

This is an expanded and tabulated account of the writers' tests at the Colorado Agricultural Experiment Station to determine the relation of handling methods to the incidence of anthracnose (*Colletotrichum lagenarium*) in Honeydew melons, a note on which has already been published from another source [*R.A.M.*, xxi, p. 512]. It is stated in the present paper that as few as four diseased fruits, gently rinsed in 4 l. water, provided a source of inoculum for the healthy melons washed in the same tank. The spores of the fungus were inactivated by five minutes' immersion in a solution containing chlorine at a strength of 120 p.p.m., but even at a concentration of 1,000 p.p.m. the chemical failed to destroy all the conidia embedded in active lesions on the melons. No injury to the host was caused by treatment with 10,000 p.p.m. chlorine for five minutes.

Cook (H. T.) & Harter (L. L.). **Chemicals effective for Sweet Potato seed treatment.**—*Bull. Va Truck Exp. Sta.* 109, pp. 1801–1807, 1942.

A tabulated account is given of laboratory and seed-bed tests to determine the relative efficacy of various chemicals in the control of sweet potato black rot (*Ceratostomella fimbriata*), the results of which showed that ten minutes immersion of the 'seed' in 2 per cent. boric acid, five or ten minutes in 2·5 per cent. borax, and ten minutes in 0·1 per cent. mercuric chloride plus 3 per cent. wettable sulphur eliminated infection without impairing sprout production. At the present juncture, mercuric chloride is both difficult to obtain and very costly, and its replacement by borax or boric acid (preferably the former) is therefore indicated. Mercuric chloride alone and 1·6 per cent. semesan bel (one-minute dip) also effectively combated *C. fimbriata*, but significantly reduced the yield of sprouts.

Bond (T. E. T.). **Pod spot of Okra (Hibiscus esculentus L.) and a leaf spot of Hibiscus rosa-sinensis L. in Ceylon.**—*Trop. Agriculture, Trin.*, xx, 4, pp. 67–70, 4 figs., 1943.

In 1941, *Hibiscus rosa-sinensis* in the author's garden at St. Coombs, Talawakelle, Ceylon, became affected by a leaf spot, attributed at the time to an unidentified species of *Phyllosticta*. A year later, *H. esculentus*, in the same garden, was attacked by a destructive pod disease associated with *Ascochyta abelmoschi* [*R.A.M.*, xviii, p. 413]. Further examination of the fungus previously thought to be a *Phyllosticta* showed that it was, in fact, an *Ascochyta*, and that it might be *A. abelmoschi*.

The fungus associated with the okra pod spot showed immersed, erumpent, dark brown pycnidia with a dark, thickened rim round the ostiole. Measurements of 50 pycnidia showed that the diameter measured 60 to 130 (mean $102{\cdot}5 \pm 2{\cdot}25$) μ, while the ostiole diameter was 10 to 30 ($19{\cdot}2 \pm 0{\cdot}61$) μ. The ripe pycnidia extruded spore tendrils immediately on immersion in water, which measured 3 to 4 mm. by 20 to 30 μ. The hyaline, oval to oblong or very slightly curved spores were rounded at the ends, sometimes guttulate, mostly continuous, but with a small percentage of bicellular spores, sometimes slightly constricted at the septum. A mixed population of 100 spores measured in water showed the dimensions to be 4·5 to 9·5 ($6{\cdot}5 \pm 0{\cdot}14$) by 2 to 4 ($2{\cdot}8 \pm 0{\cdot}05$) μ. A random selection of ten spores of each type gave the following mean measurements: unicellular 5·9 by 2·7 μ, bicellular 7·6 by 3·1 μ. The fungus grew readily with copious aerial mycelium on maltose agar plates and on steamed potato cylinders, but formed no pycnidia in one month.

In the case of the disease of red *Hibiscus* the pycnidia resembled those described above, except that they were more regularly circular. Measurements from a sample of 25 seen *in situ* in 1941, showed the diameter to be 105 to 200 ($153{\cdot}6 \pm 5{\cdot}66$) μ and the ostiole 15 to 40 ($29{\cdot}6 \pm 1{\cdot}08$) μ in diameter, while in 1942 the corresponding figures were 80 to 155 ($122 \pm 4{\cdot}07$) and 20 to 30 ($22{\cdot}8 \pm 0{\cdot}58$) μ. The spores were quite similar in shape and appearance to those of *A. abelmoschi*, but varied greatly in size from year to year. Spore measurements (from samples of 50) gave, in 1941 (no bicellular spores) 4·5 to 7·5 by 2 to 3 ($5{\cdot}9 \pm 0{\cdot}09$ by $2{\cdot}4 \pm 0{\cdot}04$) μ, in 1942 (with bicellular spores) 6 to 9 by 2 to 4·5 ($7 \pm 0{\cdot}11$ by $2{\cdot}8 \pm 0{\cdot}06$) μ, and at a second examination in 1942, 5·5 to 10·5 by 2·5 to 4 ($8{\cdot}4 \pm 0{\cdot}14$ by $3 \pm 0{\cdot}05$) μ, the average for the 150 spores being 7·1 by 2·7 μ.

As *A. abelmoschi* has not previously been recorded on any host but *H. esculentus* a comparison is made between the leaf spot disease observed by the author and what has been recorded on *Hibiscus* spp., a complete list of the fungi known to occur on the genus being presented. There is no outstanding analogy between any of them and the leaf-spot fungus, which is, accordingly, identified provisionally with *A. abelmoschi*.

HADORN (C.). **Vergleich der Wirksamkeit verschiedener Spritzbrühen gegen den falschen Rebenmehltau.** [Comparison of the efficacy of various sprays against Vine downy mildew.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 3, pp. 54–69, 1 fig., 4 graphs, 1943.

Further tests at the Wädenswil (Zürich) Research Station on Riesling × Sylvaner hybrids of preparations designed to control vine downy mildew (*Peronospora*) [*Plasmopara viticola*] with economy in copper consumption [*R.A.M.*, xxii, 287] are fully described and tabulated. The principal conclusions may be summarized as follows. The allegation that lime-sulphur helps to save copper must be repudiated. The efficiency of a Bordeaux-lime-sulphur mixture is in inverse proportion to the concentration of the latter compound. The admixture of lime-sulphur with Bordeaux impairs both the physical and chemical properties of the latter spray, the suspensory capacity of which rapidly declines after 1 to 1½ hours, and a precipitate of copper sulphide is formed which renders the mixture altogether useless for mildew control. The stimulus to growth reputed to result from the addition of lime-sulphur to Bordeaux mixture was not observed in the trials under discussion.

Copper cannot be replaced by zinc, aluminium, or magnesium sulphates or other metallic salts, e.g., silver, cadmium, chrome, mercury, and iron, and for the present it is therefore essential to use existing stocks with the utmost economy consistent with adequate disease control. The large-scale treatment of vines with either copper or sulphur dusts is considered to be inadmissible during the economic crisis involving the shortage of both elements.

Reed (G. M.). **Report on research for 1942. Plant pathology.**—*Rep. Brooklyn bot. Gdn.*, 1942 (*Brooklyn bot. Gdn. Rec.*, xxxii, 2), pp. 75–78, 1943.

In this report [cf. *R.A.M.*, xxi, p. 446] the author states that 45 selections of Lee × Victoria and 8 selections of Hairy Culbertson × Victoria oats were found to be susceptible (like the parents) to the new race of loose smut [*Ustilago avenae*: loc. cit.], whereas 15 selections of Victoria × Richland (including all those selected for other qualities than resistance) were resistant to the new race and to all other races tested. Two selections of Nortex × Victoria were resistant. Of 38 selections of Victoria × Fulgrain, 11 were resistant and 27 susceptible.

The second generation plants of hybrids involving Victoria and Monarch were inoculated with race 1 of covered smut [*U. kolleri*: loc. cit.], to which Victoria is resistant and Monarch susceptible. The data obtained indicate a single genetic factor for resistance. When the second generation plants of a hybrid between Markton and Navarro (both highly resistant varieties) were tested, 86 plants inoculated with race 1 of loose smut and 84 inoculated with race 1 of covered smut remained unaffected. The second generation plants of a third hybrid between Markton and Red Rustproof were inoculated with the Red Rustproof race, and of 136 plants grown 13 (or 9·5 per cent.) became infected. The third generation of these hybrids is expected to throw light on the factors for resistance involved.

Nine distinct races of loose smut and 13 of covered smut were differentiated by L. G. Utter on nine oat varieties from 1938 to 1941. The 1942 data indicate that five of the remaining collections of covered smut could be separated from the other races by the use of four further oat varieties as differential hosts. Three more collections of loose smut were differentiated by the use of three oat varieties. The differential varieties used were susceptible to race 1 of loose and race 1 of covered smut. Some gave high infections with the new races while others remained unaffected.

Bacterial soft rot [cause unspecified] appeared in the new bearded iris beds in mid-May, and reached epidemic proportions in July and August. Experiments by L. G. Utter indicated that the causal organisms were able to enter by the foliage, rhizomes, and roots. In most cases it was necessary to break the surface of these organs in a manner resembling insect injury to accomplish rotting.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 3, pp. 116–120, 8 figs.; 4, pp. 155–158, 5 figs., 1943.

Brief, popular notes are given on the following pea diseases occurring in New South Wales: *Mycosphaerella* blight (*M.*[*pinodes*]), bacterial stem blight [*Pseudomonas pisi*], powdery mildew [*Erysiphe polygoni*], downy mildew [*Peronospora pisi*], root rots [*Fusarium solani* var. *martii* f. 2 and other fungi], *Fusarium* wilt (*F.* [*orthoceras* var. *pisi*]), spotted wilt, and mosaic. Spotted wilt (caused by the tomato spotted wilt virus) sometimes occasions appreciable losses. The symptoms appear as necrotic, purplish- to bluish-brown streaks on the stems, sometimes extending along their entire length. One-sided development of affected plants is often noted, and spotting and vein necrosis occur on the young leaves and pods. Mosaic is somewhat widespread, but causes only slight loss. The leaves of the more mature plants show light and dark areas characteristic of mosaic diseases. Tall vine varieties are said to be more seriously affected than canning types.

The Department of Agriculture has built up stocks of disease-free seed, and it is hoped that pea seed reasonably free from disease will be available to growers in the near future. Long crop rotations are recommended, though shorter ones of three to five years may in some cases be sufficient. All pea seed should be dusted before sowing with copper oxychloride (2 oz. per bush.) or an organic mercury dust, such as agrosan, ceresan, or zetan (1 oz. per bush.). Treated seed in 1942 trials gave 76 to 99 per cent. germination against 23 to 76 for the untreated.

Showery weather during the autumn of 1942 in the Murrumbidgee Irrigation

Area favoured the development of citrus *Septoria* spot (*S.* [? *citricola*: *R.A.M.*, xx, p. 341]). Bordeaux mixture (5–5–100 and 2½–2½–100) and copper oxychloride were applied in trials begun in late March, white oil (½ gal. per 100 gals.) being added in each instance. With navel oranges all the sprays gave almost complete control, though the unsprayed trees had up to 50 per cent. severely infected fruits. With Valencia oranges, Bordeaux mixture at the higher concentration gave nearly 100 per cent. clean fruits, but the half-strength mixture and the copper oxychloride gave a small percentage of infection. Growers who suffer loss each year should spray annually in February–March, before the autumn rains. If spraying is effected every year and the losses are not severe, the weaker Bordeaux mixture or the copper oxychloride should suffice. If fumigation against insects is necessary, it should be carried out several days before spraying.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 4, pp. 213–217, 6 figs., 1943.

These notes contain the following items of interest. Root rot of onions, caused by *Fusarium oxysporum* [*R.A.M.*, xviii, p. 7] was responsible for considerable losses (from one to three tons per acre) in the Colac district, Victoria, and also in the metropolitan area. The disease is stated to make hand-sorting of the crop essential, thus greatly increasing the cost of production. Owing to the destruction of the roots, the diseased plants are easily pulled up and the tops may turn yellow prematurely. On harvesting, the extent of damage may not be easily noticed, but upon closer examination, a soft rot of the basal plate and the lower portions of the bulb scales can be detected, and in many cases whitish fungal hyphae are visible. In storage the rot extends upwards eventually destroying all the contents and leaving only the dry shell.

Blight (*Bacterium* [*Xanthomonas*] *juglandis* [ibid., xviii, p. 91]) is stated to be the predominant disease of walnut in Victoria. If attacked by the organism at an early stage of development of the tree, the kernel usually rots or the fruit may drop prematurely; at a later stage, black, sunken areas appear, which spread slowly and may finally cover almost the entire fruit. On the leaves, small, black, necrotic spots develop, and if this type of attack is severe, the general health of the tree is affected. In order to reduce the carry-over of infection, all diseased fallen fruit and leaves should be burnt, but, in general, the disease is difficult to control. Notes on spraying as practised in America are added.

Martin (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1941–2* (ex *Printed Reps. Hawaii Sug. Pl. Ass., 1942*), pp. 23–36, 1943.

In this report [cf. *R.A.M.*, xxi, p. 349] it is stated that during the period under review tomatoes in Hawaii were severely affected by spotted wilt, little control of which resulted from weekly and bi-weekly applications of tartar emetic [ibid., xxii, p. 330]. Considerable damage was caused to young and mature tomatoes and egg-plants in several localities by *Bacterium solanacearum*. Carrot late blight (*Macrosporium carotae*) [ibid., xx, pp. 2, 560] at Kailua was in one instance very serious, causing the death of the tops. This appears to be the first record of the disease in Hawaii. In several areas, broccoli was attacked by *Erwinia carotovora*, causing a slimy, wet rot confined to the soft tissues within the main stem; side shoots were occasionally affected. Affected plants should be removed and destroyed. When broccoli plants are harvested, the stem should be cut obliquely, because if a horizontal cut is made a slight depression is formed on drying, which collects moisture and induces conditions favouring the pathogen. Knives which have been used to cut diseased plants should be sterilized. Infection takes place mainly through wounds. The same organism also caused a decay of bulb onions. The diseased tissues were water-soaked, and afterwards turned soft and mushy. The pathogen

does not appear to penetrate sound tissues or scales, but enters through the neck and spreads downwards. Affected onions should be sorted and promptly marketed, or be dried and stored under dry conditions.

Studies of the Chytrid associated with sugar-cane chlorotic streak [ibid., xx, p. 276] were continued by C. H. Carpenter; this is the only invading organism so far observed in association with this disease with sufficient constancy for it to be regarded as a cause of the symptoms. The apparent recovery or masking of the symptoms observed in Queensland has been attributed to the high internal temperature of the stalks when exposed to the sun, and in this connexion it is pointed out that the causal agent becomes inactivated at a relatively low temperature, for in Hawaiian experiments some 90 per cent. healthy shoots developed from diseased cuttings after treatment in water at 45° C. for 20 minutes [cf. ibid., xii, p. 722]. A. F. Bell has reported an internal stalk temperature of 44·5° in recumbent cane in the field, and this may explain why the disease persists to a marked degree only in the wetter areas, where sunlight is less and rather lower temperatures prevail than is the case in the drier parts.

The first ratoons of two chlorotic streak experiments with 31–2806 begun in July 1938, were harvested in July, 1942. Statistical analysis of the yields showed a definitely beneficial effect on cane and sugar yields from the hot-water treatment of affected cuttings and from the use of healthy as compared with diseased cuttings. In the plant crop there was very little chlorotic streak in the plots planted with healthy cuttings or diseased, treated ones, but in the ratoon crop the condition was moderate to severe in all plots. In the second experiment, all plots were planted with selected healthy, hot water-treated cuttings of 31–2806. In the plant crop all plots remained comparatively free from disease, but in the ratoon crop all plots were moderately affected.

In a test of comparative resistance to chlorotic streak, 28–1813, 28–4291, 29–3859, 31–624, and 34–2635 showed no symptoms, while 31–2484, 34–2095, U.D.50, Yellow Caledonia, P.O.J.36, and D.1135 were only slightly affected.

The seriousness of eye spot [*Helminthosporium sacchari*: ibid., xxi, p. 349] has greatly diminished with the rapidly increased use of resistant varieties, notably 32–8560, while 32–1063 and 32–3575 have also assisted in control.

Leaf scald [*Xanthomonas albilineans*: loc. cit.] has not, so far, been found on 32–1063 or 32–8560. Planted in areas where infection has been severe, these varieties have given very high sugar yields.

The very low incidence of sugar-cane mosaic in Hawaii is due to the selection of healthy planting material, improved control of weeds, and the roguing of affected canes in combination with the use of resistant varieties.

Starr (M.P.) & Weiss (J. E.). **Growth of phytopathogenic bacteria in a synthetic asparagin medium.**—*Phytopathology*, xxxiii, 4, pp. 314–318, 1943.

With the technical assistance of H. P. Klein and Charlotte B. Sisselman, the writers tested the capacity of 173 isolates of phytopathogenic bacteria, consisting of 66 different species and varieties, to grow through four consecutive transfers at 27° C. in a synthetic medium containing asparagin as the sole source of both carbon and nitrogen. Certain genera and groups comprising Bergey's superseded genus *Phytomonas* [*R.A.M.*, xxi, p. 517] were found to exert a distinctive action on the substratum, a character that may serve as a valuable aid to the classification of the bacterial plant pathogens. All 60 isolates of *Pseudomonas* grew well on repeated transfer on the synthetic medium, whereas none of the 57 *Xanthomonas* isolates could do so. Among the organisms utilizing asparagin were *Agrobacterium* [*Bacterium*] *gypsophilae* (the genus *Agrobacterium* was recently established by Conn: *J. Bact.*, xliv, pp. 353–360, 1942 to include gall-forming phytopathogenic bacterial and related soil forms), *A.* [*Bact.*] *radiobacter*, *A.* [*Pseudomonas*] *savastanoi* and its

var. *fraxini*, *A.* [*Bact.*] *tonellianum*, *A.* [*Bact.*] *tumefaciens*, *Corynebacterium fascians* (the only phytopathogenic species of this genus that grew on the asparagin medium), *Phytomonas* [*Xanthomonas*] *stewarti*, *Pseudomonas alliicola*, *P. angulata*, *P. atrofaciens*, *P. caryophylli*, *P. cichorii*, *P. coronafaciens*, *P. delphinii*, *P. jaggeri*, *P. lacrymans*, *P. maculicola*, *P. medicaginis* var. *phaseolicola*, *P. mellea*, *P. pisi*, *P. polycolor*, *P. primulae*, *P.* [*Bact.*] *solanacearum*, *P. striafaciens*, *P. syringae*, *P. tabaci*, *P. tomato*, *P. viridiflava*, and *P. viridilivida*. *X. stewarti* differs from most species of *Xanthomonas* in its lack of flagella, failure to peptonize milk, or to produce hydrogen sulphide, and inability to attack cotton seed oil (as shown by the spirit blue agar technique) [*R.A.M.*, xxi, p. 517], and to these criteria are now added its ability to grow in a medium in which asparagin is the sole carbon and nitrogen source as contrasted with the inability of typical *X.* spp. to grow under identical conditions. For these reasons the authors suggest that the name *Phytomonas stewarti* be retained until the precise taxonomic position of that species is determined.

Breed (R. S.) & St. John-Brooks (R.). **International Association of Microbiologists Nomenclature Committee. Appointment of Judicial Commission on Bacteriological Nomenclature.**—*Brit. J. exp. Path.*, xxiv, 2, pp. i and ii, 1943.

In accordance with the decision of the Third International Congress for Microbiology held at New York in September, 1939 [*R.A.M.*, xix, p. 554], a Judicial Commission on Bacteriological Nomenclature has been appointed, consisting of R. E. Buchanan, A. J. Kluyver, E. G. D. Murray, S. Orla Jensen, J. Howard Brown, A. R. Prévot, J. Ramsbottom, Th. Thjötta, A. Lwoff, E. Renaux, A. Sordelli, and C. Stapp. This arrangement has been made in the hope that some plan for taking tentative action on questions of nomenclature can be developed by those members of the Commission who can be reached under war conditions.

In a note by Dr. R. St. John-Brooks, Lister Institute, Elstree, Hertfordshire, it is stated that any questions respecting the interpretation of rules or recommendations in nomenclature may be submitted in the prescribed manner to the Chairman, Professor R. E. Buchanan, but bacteriologists in Great Britain and the British Empire may find it convenient to apply to him in the first instance.

It is hoped that the Judicial Commission will consider, *inter alia*, the proposed Bacteriological Code of Nomenclature.

Dowson (W. J.). **On the generic names Pseudomonas, Xanthomonas and Bacterium for certain bacterial plant pathogens.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 4–14, 1943.

The author is in favour of discarding the genus *Erwinia*, which was founded on one character only, its pathogenicity to plants; the few chemical activities recorded in its definition may equally apply to other genera. Such segregation of plant pathogens from the similar colon-typhoid group of bacteria is not considered justifiable. It is argued generally that the time is not ripe yet for the erection of a large number of bacterial genera, and that in classifying the colon-like bacteria, one generic name, *Bacterium*, should be adopted for the whole group. As the type species, *Bact. triloculare*, is not recognizable, it is suggested that a new type species should be designated. Accordingly, it is recommended that (1) the generic names *Erwinia*, *Escherichia*, *Eberthella*, *Salmonella*, and others of Bergey's Enterobacteriaceae such as *Shigella*, *Klebsiella*, and *Aerobacter* be discarded, (2) *Bacterium* Ehrenberg, 1828 be designated a *nomen conservandum*, (3) the type species of *Bacterium* be designated as *B. coli* Escherich, 1885, and (4) the genus *Bacterium* be so defined as to include not only those species universally regarded as constituting the colon-typhoid-dysentery group but also the peritrichous plant pathogens.

A list is given of the Gram-negative bacterial plant pathogens to be included in the three genera *Pseudomonas*, *Xanthomonas*, and *Bacterium*. Among those

included in the first group the following new combinations are of interest: *P. betae, P. bowlesii, P. calendulae, P. cumini, P. eriobotryae, P. gardeniae, P. panacis, P. primulae, P. punctulans* for *Phytomonas betae, P. bowlesii, Bact. calendulae, P. cumini, Bact. eriobotryae, P. gardeniae, Bact. panaxi, P. primulae,* [*Bact. punctulans*], respectively, and also *Pseudomonas medicaginis* var. *phaseolicola* and *P. savastanoi* var. *fraxini* for which two organisms the author proposes the names *P. phaseolicola* and *P. fraxini*, respectively. In the second group are, among other species, the following new combinations: *X. albilineans, X. alfalfae, X. antirrhini, X. celebensis, X. corylina, X. dieffenbachiae, X. holcicola, X. gummisudans, X. itoana, X. lactucae, X. nakatae, X. nigromaculans, X. oryzae, X. phormicola, X. rubrilineans, X. tardicrescens,* and *X. vitians* for *Bact. albilineans, Phytomonas alfalfae, Pseudomonas antirrhini, P. celebensis, Phytomonas corylina, Bact. dieffenbachiae, Bact. holcicola, Bact. gummisudans, Pseudomonas itoana, Bact. lactucae, Bact. nakatae, Bact. nigromaculans, Pseudomonas oryzae, Bact. phormicola, Phytomonas rubrilineans, P. tardicrescens,* and *Bact. vitians*, respectively. Finally, the third group comprises the following 15 organisms: *Bact. amylovorum, Bact. ananas, Bact. aroideae, Bact. carotovorum, Bact. cassavae, Bact. citrimaculans, Bact. mangiferae, Bact. marginatum, Bact. phytophthorum, Bact. pseudotsugae, Bact. rhaponticum, Bact. rhizogenes, Bact. salicis, Bact. tracheiphilum,* and *Bact. tumefaciens.*

Riker (A. J.). **Bacteria pathogenic on plants.**—*Publ. Amer. Ass. Adv. Sci.* 12, pp. 46–56, ? 1940. [Received June, 1943.]

The author suggests that many of the broad fundamental questions in biology, equally interesting to human, animal, and plant bacteriologists, can be approached through genetic studies of phytopathogenic bacteria with a facility worthy of special consideration. The bacteria pathogenic to plants produce a wide range of symptoms on many different kinds of hosts and show a considerable range of variability, while the technical advantages of working with plants are manifold.

Riker (A. J.). **The relation of some chemical and physico-chemical factors to the initiation of pathological plant growth.**—Reprinted from *Growth, Fourth Growth Symposium*, vi, pp. 105–117, 3 figs., 1942.

Among the important factors bearing on the problem of pathological plant growth (as illustrated by *Phytomonas* [*Bacterium*] *tumefaciens* galls and comparable non-parasitic growths), the following are discussed: loss in pathogenicity of the cell-stimulating bacteria induced by amino acids; their recovery of pathogenicity in certain media and after ultra-violet treatment; oxygen hunger of the plant cells; changes in osmotic pressure, which may induce swelling of plant cells; the presence of exceptional amounts of enzymes and of growth substances such as thiamin, riboflavin, pantothenic acid, and biotin; bacterial metabolites, e.g., ammonia, phosphatides, phospholipides, and polysaccharides, which irritate plant cells; and the presence of abnormal amounts of food materials. When some of these and other important factors are present in unusual combinations and proportions, living cells generally begin to enlarge and multiply. The initiation of pathological growth may perhaps be associated with an unbalanced combination of such factors.

Pound (F. J.). **The quest for witches' broom resistant trees.**—*Proc. agric. Soc. Trin. Tob.*, xliii, 1, pp. 55–63, 1943.

In this interesting survey of the author's journeys to the Amazon Valley, he relates that he returned in 1942 to obtain budded progeny or rooted cuttings of cacao trees marked by him as free from witches' broom disease [*Marasmius perniciosus*: *R.A.M.*, xxii, p. 163] in 1938 and since reported to have remained unaffected. Of the trees tagged in the peninsula between the Navay and the Amazon, to the east of Iquitos [Peru], all were still healthy save one, which showed one

point of infection. This region (which is in a heavily infected area) was surveyed in detail, with the result that a group of 27 trees was found, about half of which were very slightly infected, while the remainder were quite healthy. It was then ascertained that these trees had been planted many years before from the seeds of a single cacao pod from the Rio Napo.

In all, 32 trees were selected, all of them entirely free from infection, some being known to have been unaffected since 1938. Most were growing in well shaded situations, but others grew better with much less shade, and it seemed apparent that trees with a certain degree of resistance develop very little infection when growing in full sunlight. If this proves to be the case, and the immortel trees [*Erythrina velutina* and *E. umbrosa*] can be removed, cacao cultivation in Trinidad will be facilitated.

The beans produced on the Amazon are large and plump, but no pale ones were seen. All were uniformly purple, but in many cases the pods, with their warty surface and long point, looked as if they contained genes of criollo types. Samples of cacao from the introduced trees are to be prepared, but the chief task at present is to propagate and test the new strains.

Brown (E.) & Robert (Alice L.). **Alternaria sp. on grain kernels killed by high temperature storage.**—*Phytopathology*, xxxiii, 4, pp. 333–335, 1 fig., 1943.

A species of *Alternaria* of the *tenuis* group was found to be present on seed-grain of oats from Idaho, wheat from Nebraska, and barley from Virginia stored from six to 15 months at 36° and 50° F., whereas at 105° the fungus was absent. In a germination test made in 1940 on wheat samples to confirm these observations, the mould was found in abundance, after a week's incubation at 68°, on seed from a lot stored for seven months at 50°, while the grain that had been kept for the same period at 105° was quite sound.

Fitzgibbon (M.). **Seed disinfection. The determination of the adhesiveness of seed dressings to cereal seeds.**—*J. Soc. chem. Ind., Lond.*, lxii, 1, pp. 8–11, 1 fig., 1 diag., 1943.

The degree of control of cereal diseases by the treatment of the seed-grain with organo-mercurial dry dressings being largely dependent on the facility with which the powder is distributed over, and remains adhering to, the seed, a procedure was devised at Lunevale Products, Ltd., Queen's Mill, Manchester, enabling the adhesiveness of such products to be determined in relation to any given seed. Carefully selected lots of seed (30 gm. of peas and wheat and 25 of oats and barley) were dressed with a known weight of fungicide or filler material, and after the treated samples had been allowed to fall through a glass tube 23 by 1 in., with a 2½ in. diameter glass funnel at the top, from a moderate height (70 cm.) directly on to an 80 I.M.M. sieve, they were weighed to ascertain the amount of dressing still retained [cf. *R.A.M.*, xxi, p. 131]. The miniature seed dresser was of the churn type, a 4 oz. wide-mouthed bottle serving as a receptacle for the grain. Blank tests showed a loss in weight of wheat of 0·0016 gm. each drop and other rates more or less constant, for other seeds. Allowance for this loss is made in estimating retention.

Of the four proprietary British fungicides, designated D to G, E and G were noteworthy for their adhesion to Maple peas (0·2 per cent.) and Onward oats (0·3 per cent.), respectively. The latter preparation comprised an unusually large number of needle-shaped crystals, the penetration of which between the seed coat and seed may have accounted for its satisfactory performance, while the former contained a percentage of a partly saponified mixture of fatty acids to assist the adhesion of the particles to the relatively large and smooth-coated pea seeds. Tables are given showing the loss sustained by dressed seed in the various tests. For instance, wheat treated with D showed after 1, 2, 3, 4, and 5 drops 0·0355, 0·0285, 0·0246, 0·0215, and 0·0184 gm. retained, respectively, the mean results from two repeat trials

being 0·0351, 0·0282, 0·0244, 0·0213, and 0·0183 gm. respectively. Examination of the three Canadian dusts showed marked differences in their ability to adhere to different cereals. The addition of 0·5 per cent. oil to the talc filler improved adhesion.

It is concluded from these observations that manufacturers' specifications should aim at achieving a retention on the seed of 50 per cent. of the dressing used. The degree of subdivision should be within an upper limit of 30 μ diameter with an average particle size of 10 μ for very approximately spheroidal particles. A definite crystalline form further appears desirable.

HENRY (A. W.). **On the value of spergon for seed treatment in small-grain crops.**—*Phytopathology*, xxxiii, 4, pp. 332–333, 1943.

Wheat and oats seed-grain and flax seed were treated with ceresan, spergon, and formaldehyde at various localities in Alberta, the two cereals being inoculated with their respective covered smuts [*Tilletia caries* and *T. foetida* in the case of wheat and *Ustilago kolleri* in that of oats], and also carrying a small quantity of natural inoculum, while the flax was clean. Spergon was applied at the rate of 2 oz. per bush. a week before sowing, ceresan at ½ oz., and formaldehyde at 1 in 320. Spergon reduced the incidence of wheat bunt in four localities from between 15 and 42·5 to between 0 and 1 per cent., ceresan to between 0·2 and 2·2, while formaldehyde gave absolute control. The corresponding percentages for oats smut in three localities were from 10·8 to 17·7 to between 1·2 to 11·5, 0·0 to 0·2, and 0·0 to 0·5, respectively.

Ceresan raised the emergence of flax at Edmonton from 53 to 81·5 per cent. and the yield from 8·4 to 9·3 bush. per acre, the corresponding figures at Castor being from 59·8 to 71·1 per cent. and from 5·5 to 6·6 bush., respectively. The emergence of spergon-treated plants at Edmonton and Castor was 75·3 and 65·1 per cent., respectively, and the yields 10·2 and 6·4 bush., respectively.

The use of spergon as a seed treatment is evidently to be recommended, especially for wheat and flax.

HART (HELEN). **Stem rust on Triticum timopheevi.**—*Phytopathology*, xxxiii, 4, pp. 335–337, 1 fig., 1943.

In 1942 *Triticum timopheevi*, which is normally highly resistant to nearly all races of stem rust (*Puccinia graminis tritici*), showed 35 per cent. infection on some of the experimental plots at University Farm, St. Paul, Minnesota, all parts of the plant being involved. The reaction was one of moderate susceptibility. Wheat varieties and hybrids in the plots were exposed to stem-rust inoculum early in the season, uredospore suspensions of races 15B, 17, 34, 36, 56, and 147 being applied with a hypodermic syringe on 26th May, to border rows between the plots and repeated at five- to seven-day intervals. By 3rd June, infection was already spreading from the intervening rows to the plants in the plots, which were not directly inoculated. *T. timopheevi* was attacked only by race 15B (apparently distinct from 15, which is mildly pathogenic to the same host in Canada [*R.A.M.*, xx, p. 54]). Seedlings of *T. timopheevi* inoculated with 15B gave a type 3+ response. Loegering and Stakman have already reported (*Phytopathology*, xxxii, pp. 12–13, 1942) the virulent action of 15B on the new, hard, red spring wheat, Rival, which is immune from 15A, and drawn attention to the danger of its presence in the spring wheat area of the United States.

WHITE (N. H.). **The effect of biotin and thiamin on the growth of fungi isolated from lesioned roots of take-all affected Wheat.**—*J. Aust. Inst. agric. Sci.*, ix, 1, p. 36, 1943.

Examination of the lesioned roots of wheat plants affected with take-all showed that as the disease progressed *Ophiobolus graminis* became replaced by other fungi. Further work demonstrated that *O. graminis* was the only one among these

organisms that required biotin for growth, indicating that competition for this material in the root tissues was not a factor concerned. The growth of some of the fungi was increased when thiamin was supplied to them. To eliminate isolates suspected of being *O. graminis* in the course of cultural work, it is only necessary to inoculate a biotin-free synthetic solution with all isolates assumed to be *O. graminis*. The growth of any isolate would establish that it was not *O. graminis*.

DILLON WESTON (W. A. R.) & GARRETT (S. D.). **Rhizoctonia solani associated with a root rot of cereals in Norfolk.**—*Ann. appl. Biol.*, xxx, 1, p. 79, 1943.

In 1938, cereal crops (particularly barley, but also wheat and oats) in Norfolk were affected by a partial failure. Patches of backward, stunted plants were observed shortly after growth had started or had been resumed in spring. The diseased areas were generally small and well-defined, but occasionally they spread over ¼ acre or more. Some or all of the plants in these patches were generally dead or dying by the middle of June, while the survivors were greatly delayed in growth and still green.

The roots of the affected plants showed the presence of *Rhizoctonia* [*Corticium*] *solani*, the most conspicuous effect being the killing short of the first-formed crown roots, as in Australia [*R.A.M.*, xii, p. 159; xvii, p. 166]. The diagnosis was confirmed by isolation and by pathogenicity tests. The disease is at present only of minor importance, having been recorded from only seven farms in Norfolk. Further investigations are in progress.

MCKAY (R.). **On an epidemic of Gibberella saubinetii (Mont.) Sacc. on Wheat in Eire in 1942.**—*Sci. Proc. R. Dublin Soc.*, N. S., xxiii, 11, pp. 111–129, 2 pl., 1 map, 1943.

An epidemic outbreak of *Gibberella saubinetii* [*G. zeae*: *R.A.M.*, xxii, p. 165] on wheat is recorded in Eire in 1942. The name 'cereal scab' is proposed for this disease, which is known elsewhere as 'ear blight', 'wheat scab', '*Fusarium*-blight', or 'headblight'. A memorandum sent out by the Department of Agriculture established the presence of the disease in 10 counties on five different varieties of wheat, but as the investigation was started very late in the season, after much of the grain had been threshed, it is quite possible that the disease was present also in the remaining counties. The reduction in yield (at an estimated average normal yield of 1 ton of grain per statute acre) caused by the disease amounted to 21·8, 38·4, and 55 per cent., respectively, in the three counties chosen for comparison. Apart from this reduction in weight of grain, much of the harvested crop consisted of shrivelled grain of low germinability. Although the fungus may attack any part of the wheat plant, the greatest losses occur when the ears are affected. Infection of the ears may take place from the flowering period onwards throughout the time the grain is in the stooks, but it is most harmful in the period between flowering and the 'soft dough or setting' stage. The earliest symptoms consist in small brown or water-soaked spots on the outer glume, which may in time cover one entire spikelet or, under wet weather conditions, a whole group of spikelets. Occasionally the whole head becomes diseased, frequently the grains too are invaded, and many of the spikelets are either completely barren or contain a few shrivelled grains. The pink or reddish discoloration of diseased grains was very prominent in 1942, being most intense at the germ-end. Perithecial development occurred freely and was apparently influenced by moisture rather than temperature.

Perithecia were also found on panicles of oats (varieties Marvellous and Victory II) in County Galway, this being the first record of the fungus on oats under natural conditions in the British Isles.

The epidemic in 1942 was associated with abnormally rainy weather, starting early in July; the summer of that year had the least sun and was the wettest in Eire for 11 years. It is believed that the disease had been endemic in certain dis-

tricts of Eire for a considerable time. *G. zeae* was recorded for the first time in Eire in 1918 by Lafferty; since then, samples of diseased grain received by the Department of Agriculture in 1930 were found to harbour a species of *Fusarium*, which was probably the conidial stage of *G. zeae*, as the outward appearance and the toxic properties of the grain would seem to suggest. Furthermore, diseased specimens and reports received from counties on both the eastern and the western coasts indicated that the disease had been present there on several occasions since 1930. All observations on growing crops previous to 1942 refer only to a *Fusarium* stage, and may, therefore, have included several species, but it is assumed that *G. zeae* is likely to have been among them.

In a footnote it is stated that seedling blight due to *G. zeae* was reported from several counties after the present paper had gone into print. In practically every case, February sowings of the wheat variety Queen Wilhelmina were affected.

O'Connell (T.). **Storage and treatment of seed Wheat.**—*J. Dep. Agric. Éire*, xxxix, 2, pp. 224–229, 1942.

This broadcast talk deals with thin stands of wheat ascribed, particularly in late-sown crops, to the use of low germinating wheat. Since loss of germinability in wheat grain is most definitely associated with high moisture content [see next abstract], it is recommended that seed-grain be thoroughly dried prior to storage during winter. Seed-grain that has been stored in a cold loft or barn should not be sown before being tested for germination. This caution applies particularly to sowings made in late winter or spring, since wheat sown in autumn (October and November) very rarely produces thin stands.

Lafferty (H. A.). **On the moisture content of Wheat in relation to its bushel weight and keeping quality.**—*J. Dep. Agric. Éire*, xxxix, 2, pp. 230–244, 2 graphs, 1942.

The results of trials started in 1940 indicate that a high degree of moisture (exceeding 14·5 per cent.) is detrimental to the keeping quality of wheat seed-grain. When stored in closed jars, grain containing 18·5, 24·9, 19, and 25·7 per cent. moisture developed abundant growth of *Penicillium* and *Aspergillus*, while that with a high moisture content (30·4 and 30·7 per cent.), had a decidedly alcoholic smell and showed masses of yeast spores (*Saccharomyces* sp.), but no moulds. It is suggested that the absence of filamentous fungi from these samples may be due to the inhibiting effect of the alcohol produced by the yeasts. It is concluded that when the moisture content of mature wheat of good quality is reduced to 13 per cent. or under, it may be stored with safety in bags or other containers. The most satisfactory method of reducing the moisture content of seed wheat is by kiln-drying; where this is not possible, wheat grain stored loose in bulk should be turned and thus aired periodically, but only in dry weather. Where the crop has been properly harvested in the field the best and safest way to keep it over the winter is in the stack.

Phipps (I. F.), Hockley (S. R.), & Pugsley (A. T.). **Warigo—a disease-resistant Wheat.**—*J. Aust. Inst. agric. Sci.*, ix, 1, pp. 17–20, 3 figs., 1943.

After stating that wheat stem rust (*Puccinia graminis*) is estimated to have caused a loss of £1,500,000 in South Australia during 1941, the authors report that the Nabawa × Hope crossbred, developed at the Waite Institute, and then in the F_{10}, showed resistance in all areas where infection was severe. At the conclusion of the season, this wheat (strain 37–76) was released to farmers under the name 'Warigo'. The mature plant shows high resistance to the predominating Australian race of stem rust (34), though the seedling stage is susceptible to it. Warigo is also highly resistant at maturity to Australian race 16 of leaf rust (*P. triticina*). To flag smut (*Urocystis tritici*) it is even more resistant than is Nabawa; in tests in

which Federation and Free Gallipoli wheat showed 70 to 80 per cent. infection, Nabawa usually had 1 to 3 per cent. disease, and Warigo always less than 1 per cent. As regards bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*], Warigo appears to have inherited a partial resistance from Hope. When tests were made with a collection of strongly pathogenic strains, Hope, Warigo, and Nabawa generally showed 0 to 5, 35 to 45, and 60 to 70 per cent. infection, respectively. More resistance than is shown by Warigo will be necessary before 'pickling' can be dispensed with. Inoculations made in 1940 with a single collection of loose smut (*Ustilago tritici*) gave 100 per cent. infection in Ranee, as against only 1 per cent. in Warigo. This result was confirmed in 1942. In the field, Warigo has always shown high resistance to the prevailing races of powdery mildew (*Erysiphe graminis*). Under certain glasshouse conditions, some infection may develop on it, and on Hope, though Thew and Sonora remain unaffected.

Saxby (S. H.). **Eye-spot in Wheat.**—*N.Z. J. Agric.*, lxvi, 5, pp. 257–261, 4 figs., 1943.

An outbreak of eye spot of wheat (*Cercosporella herpotrichoides*) [*R.A.M.*, xxi, p. 521] is reported for the first time for New Zealand from the Taieri district of Otago, and later the disease was also found in three other districts. It is estimated that approximately 300 acres are severely, and 600 acres or more moderately infected. Slight attacks did not seem to result in any apparent decrease in yield, but one severely infected area, which under normal conditions could be expected to yield 80 bush. per acre, yielded only 2 of very poor quality wheat, while less severely infected areas yielded 30. The chief variety of wheat grown in the Taieri district is stated to be Cross 7; there is, however, no evidence to show that it is more susceptible to eye spot than any other variety. The following control measures are recommended on the basis of the available knowledge of the disease: no wheat should be sown on land on which infected wheat grew during the previous year, or on which wheat or barley has been recently grown; all seed harvested from infected crops should be used for milling or feeding only; in order to reduce the danger of reinfection, all infected stubble should be burnt; and straw from infected crops should not be used for distribution.

Tapke (V. F.). **Physiologic races of Ustilago nigra.**—*Phytopathology*, xxxiii, 4, pp. 324–327, 1943.

Seven different races of *Ustilago nigra*, the loose smut infecting barley seedlings [*R.A.M.*, xxii, p. 298], were encountered among 168 collections from 23 States of the American Union, of which Minnesota provided the largest number (31), followed by Wisconsin, Texas, Pennsylvania, and New York, with 25, 17, 16, and 15, respectively. Race 4 was encountered more frequently than all the others combined and was widely distributed: it may be identified by the susceptibility of the Hannchen C.I. 531 (20 to 46 per cent. from 1935 to 1941), Lion C.I. 923 (16 to 37), and Odessa C.I. 934 (35 to 82) varieties, the other three used for differential purposes, viz., Excelsior C.I. 1248, Himalaya C.I. 1312, and Nepal C.I. 595 being immune or very highly resistant. These reactions resembled those to race 6 of *U. hordei* [ibid., xvii, p. 308]. It is apparent that the existence of physiologic races must receive consideration in breeding projects for resistance to *U. nigra*.

Thatcher (F. S.). **Cellular changes in relation to rust resistance.**—*Canad. J. Res.*, Sect. C, xxi, 5, pp. 151–172, 3 pl., 3 graphs, 1943.

In further studies on changes in host cell permeability induced by fungal parasitism [*R.A.M.*, xxi, p. 468], it was found that the browning phenomenon caused in Kubanka wheat inoculated with *Puccinia graminis tritici* race 34 by encystment of haustoria and brown discoloration of cell walls, is accompanied by a progressively increasing permeability of host cells. The browning symptom is interpreted as an

expression of a change in the micro-environment of the fungus induced essentially by high temperature, which changes the host reaction from complete susceptibility to a type of resistance lethal to fungus growth.

In studying the mesothetic or *x* reaction of Thatcher wheat to *P. g. tritici* race 56, resistance was found to be associated with greatly decreased permeability, and susceptibility with an increased permeability of host cells, these results being in agreement with reactions shown by different varieties of wheat to several races of the rust. Hardening of wheat plants to cold, which under some conditions caused a slight lessening of resistance symptoms, did somewhat increase the permeability of host cell membrane, but this initial effect tended to be obscured by the effects of other, as yet unknown, factors. Infection of oats, barley, wheat, and maize plants with *Ustilago levis* [*U. kolleri*], *U. hordei*, *Tilletia levis* [*T. foetida*], and *U. zeae*, respectively, did not alter the degree of susceptibility to their specific rusts (*P. g. avenae*, *P. g. secalis*, *P. g. tritici*, and *P. sorghi*, respectively). In an incomplete experiment with Hope wheat inoculated with *P. g. tritici* race 21, high osmotic pressure was found to exist in resistant mature leaves (17·8 atmospheres), the values for susceptible seedling leaves, culms, and glumes being much lower (from 11 to 11·82, 11·8, and 11·2 atmospheres, respectively). It is tentatively suggested that although high osmotic pressure *per se* may not be interpreted as a cause of resistance, yet a lack of availability of water to the parasite may be a contributing factor to resistance in mature plants of this group. Vital histological examination of resistant flecks on Vernal wheat inoculated with *P. g. tritici* race 34, indicated that a fungus secretion causes death of the host cells some time before the parasite itself is injured. Although need for further investigation is stressed, it is suggested that host cell permeability may perhaps be affected by some enzymes (possibly one protease and one lipase) secreted by the fungus, and be either increased or decreased, depending upon which of the enzymes was operating.

Bitancourt (A. A.). **Recomendações para combater e minorar os estragos da 'podridão das radicelas' dos Citrus. Ainda sobre a 'podridão das radicelas' dos Citrus.** [Recommendations for the control and reduction of the ravages of Citrus 'root rot'. More about Citrus 'root rot'.]—*Biológico*, ix, 2, pp. 41–44, 1943.

Since 1937 a citrus root rot, previously unknown in Brazil but lately recognized as identical with the disease responsible from 1933 onwards for such heavy damage in the northern Argentine [*R.A.M.*, xxi, p. 485], has been decimating groves of sweet grafted on sour oranges in São Paulo, where tangerines and, to a lesser extent, grapefruit on the same stock are likewise susceptible. The principal measure of control consists in the use of resistant stocks, such as rough and Persian lemons and *Citrus* [*Poncirus*] *trifoliata*, technical directions for the introduction of which into existing plantations are given.

Cane mosaic disease legislation.—*J. Jamaica agric. Soc.*, xlvi, 8–9, p. 210, 1942.

Under the Mosaic Disease of Sugar Cane Order, 1942, superseding the one of 1936, any district of Jamaica within a $\frac{1}{4}$ mile of sugar-cane cultivation five acres or more in extent is considered a cane priority district in which maize and guinea corn [sorghum] may not be grown within 100 yds. of cane. Permission must be obtained by every grower who proposes to extend his cane-growing area to five acres or more should the new cane planting come within 100 yds. of maize land. The roguing of young cane (less than four months old) remains compulsory, but an appeal can be made to the Director of Agriculture concerning the treatment to be employed in cases where there is more than 10 per cent. infection. The order forbids the use of planting material from fields with more than 10 per cent. infection. The Director of Agriculture may enforce the planting of only resistant or immune varieties of cane in any area where he may consider this desirable.

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MILLIKAN (C. R.) & LUDBROOK (W. V.). **Maize diseases in Victoria.**—*J. Dep. Agric. Vict.*, xli, 4, pp. 207–212, 8 figs., 1943.

Following a severe outbreak of root, stalk, and ear rots of maize in Victoria during the 1934–5 season, when a loss of about 150,000 bush. was caused in the Orbost district, a study of this group of diseases was conducted till 1942 by the Department of Agriculture, assisted since 1940 by the Council for Scientific and Industrial Research. The greatest losses, under Victorian conditions, are ascribed to ear rot [*R.A.M.*, xxi, p. 407], caused mainly by *Diplodia zeae*, although at times *Gibberella fujikuroi* var. *subglutinans* may be more common. The data concerning ear rot suggest that a check to plant growth through lack of moisture at tasseling may dispose maize to infection, the development of which requires suitable atmospheric conditions later in the season. During the very dry season of 1938–9 at Boisdale crops irrigated before tasseling were good, while those irrigated later were poor. Root and basal stalk rot is thought to be largely dependent upon climatic conditions, and infection usually follows natural senescence or premature physiological breakdown of the stalks. The latter may be induced by a sudden lack of moisture at tasseling and has been observed to occur on a large scale in Victoria, to be followed by extensive fungal rotting of the root and stem bases and shrivelling or complete absence of ear, under the following conditions: (1) in the first maize crop after a three-years pasture in a rotation experiment at Orbost, following a severe set-back during a dry spell at tasseling, and (2) in crops growing on a layer of rich alluvial surface soil overlaying an open sandy subsoil, following a dry spell at tasseling, when the plants may collapse through lack of reserve moisture in the subsoil. Further support for this view was afforded by the fact that an insignificant amount of disease developed in the presence of ample moisture in the soil when rainfall was sufficient to maintain a moist subsoil. Apart from these instances root and basal rot was largely confined to plants that have ripened somewhat prematurely but carried an average ear.

Seedling blight appears to be of minor importance in Victoria, but if cold wet conditions follow planting a considerable loss of stand may occur. Treatment with agrosan improved germination 38 per cent. and increased the yield from 66·8 to 80·4 bush. per acre.

Limited tests failed to find a disease-resistant maize among foreign hybrids; among local varieties none was very resistant, but Hickory King (with horny endosperm) developed slightly less ear rot during two seasons than white or yellow varieties with starchy endosperm. In crop-rotation experiments, maize after legumes showed 14·3 per cent. of basally rotted stalks at harvest, maize after oats 7·5 per cent., and maize after no green manure 8·1 per cent., the results offering little promise for disease control by green manuring with legumes.

Tratamento das Laranjeiras no Estado de São Paulo. [The treatment of Oranges in the State of São Paulo.]—*Biológico*, ix, 4, pp. 93–95, 1943.

Directions are given for the treatment of oranges in São Paulo against foot rot [*Phytophthora* spp., including *P. citrophthora* and *P. parasitica*], scab [*Elsinoe*

australis: *R.A.M.*, xx, p. 110], melanose [*Diaporthe citri*], and leprosis. Foot rot may be combated by the exposure of the collar and roots of the trees, to which 2 per cent. Bordeaux mixture should be applied, the operations being preferably carried out during the months of July and August, before the renewal of growth. The trench encircling the uncovered roots should be permanently maintained and kept clear of obstructing refuse, soil, and the like.

Scab attacks sweet oranges at a very early stage in the development of the fruits, when they are less than 1 cm. in diameter. Spraying with 1 per cent. Bordeaux mixture plus a miscible oil spreader, e.g., citrol, should begin in September, about a fortnight after the fall of two-thirds of the petals.

Similar methods are applicable for the control of *D. citri*, which is apt seriously to lower the market value of the fruits. The pathogen thrives among the dry wood of old groves and is little in evidence in young, vigorous plantings. Cultural measures should include a thorough winter pruning to remove all shrivelled material, and improvement of the soil by tillage, harrowing, and the cultivation of green manures or the maintenance of an 'undergrowth' of Guinea grass [*Panicum maximum*] and other plants during the rainy season: this should be cut in April and left lying on the surface of the soil where it acts as an excellent covering, helping to prevent the evaporation of moisture in dry weather and the destruction of the microbiological population by the sun's rays.

Leprosis, prevalent from January to April, is amenable to treatments which exterminate the insect vectors of the disease, e.g., spraying with 1 per cent. miscible oil or lime-sulphur, one application being given in January and another, if necessary, at the beginning of March.

Klotz (L. J.). **Phytophthora infections of Citrus.**—*Calif. Citrogr.*, xxviii, 8, pp. 200–201, 220–221, 4 figs., 1 graph, 1943.

The author gives the geographical distribution (recently revised by H. S. Fawcett) of the species of *Phytophthora* found on citrus, especially those concerned in brown rot [*R.A.M.*, xxii, p. 132], chiefly *P. citrophthora* (which is now listed in the Argentine and Brazil), *P. parasitica*, and *P. hibernalis*, and briefly reviews the work done on the disease. A method of securing sufficient quantities of zoospores for experimental purposes is described, consisting in growing the mycelium on sterilized lucerne stems for one to two weeks and then transferring the stems with the fungus growth to running water. Sporangia developed abundantly in 24 hours; to induce the discharge of zoospores a sudden slight lowering (in the case of *P. parasitica* lowering or raising) of temperature was sufficient.

In recent spraying experiments on lemon trees with spreader-stickers in conjunction with Bordeaux mixture, copper oxychloride, tetrachloro-para-benzoquinone, and other materials, five gave satisfactory results, namely, petroleum oil with sulphonic salts and an organic surface tension depressant, sodium oleyl sulphate plus a synthetic resin, metal soap with casein and sulphonic salts in a petroleum oil emulsion, whale oil-resin soap, and casein (the parent product, not its calcium or sodium salts), all used at 0·5 lb. per 100 gals. The value of the copper materials was again evident, but outstanding results were obtained with the new fungicide tetrachloro-para-benzoquinone (*Citrus Leaves*, xxiii, pp. 11–13, 1943), which entirely controlled brown rot in 14 lots each of 20 lemons from sprayed trees, when applied in concentrations ranging from $\frac{1}{4}$ to 1 lb. per 100 gals., while control fruits from unsprayed trees had an average of from 25 to 40 infections per lemon. The material did not seem to aggravate fumigation injury and left no visible deposit even when used at the rate of 1 and $\frac{1}{2}$ lb. per 100 gals. The hope is expressed that its cost will be put on a competitive basis with copper materials in view of the scarcity of the latter. It is suggested that growers try the new material on a few trees in comparison with Bordeaux mixture.

FENNAH (R. G.). **The Citrus pests investigation in the Windward and Leeward Islands, British West Indies, 1937–1942.**—66 pp., 2 pl., 7 graphs, Trinidad, Imperial College of Tropical Agriculture, 1942.

In the section (pp. 38–52) of this report dealing with the dying out of seedling limes [*Citrus aurantiifolia*] in the British West Indies it is stated that in or about 1927 seedling limes in Dominica became attacked by a root disease, which, from the presence of the rhizomorphs of *Sphaerostilbe repens* on some of the dead roots was locally attributed to fungal infection and named 'red root disease' [*R.A.M.*, vii, pp. 373, 715; xxi, p. 281]. All the principal seedling cultivations in the island died out in a few years. The disease was also recorded in Montserrat and St. Lucia.

The symptoms of the 'root disease' are as follows. The leaves on one or two branches turn yellow and fall, and the fruit shrivels up, often without being shed. The affected branch is connected with a dead root by a strip of dead bark (underlying which is a strip of dead wood) running down the trunk. Sometimes, several of these dead strips run downwards side by side to their respective roots, and occasionally first one half of the tree dies, then the other. Though these are usually the first symptoms to be noted, they are signs that the final stage of the condition has been reached. The first stage shows as a shrivelling or permanent wilting of the small fibrous feeding roots of a tree apparently healthy in all other respects. Such rootlets are nearly always dead when found. The death of the woody tissues in the cambium is preceded by gum formation. Under certain conditions this gum fails to seal off the dead portion of wood. Later on, a strip of wood inside the cambium, corresponding in size to the basal portion of the dead root, dies back to the trunk, spreads upwards, and passes to a branch in vertical vascular continuity with the dead root below. This gives rise to the leaf-shedding and fruit-shrivelling. The dead wood often becomes invaded by various fungi, and turns grey, at least in the drier, above-ground parts. The cortical tissues overlying the dead wood die later than the wood beneath, copious gum frequently being produced from the adjoining healthy edges ('bleeding'). When the bark on a root has died to a certain point, the wood is usually dead for about 1 ft. farther on, while beyond it gummed tracheae extend to a point several feet above ground; such gummed wood is golden-yellow. The exposed dead wood on the larger roots is bordered by a very weak callus, and frequently the injury somewhat resembles that due to a larva of *Diaprepres* spp.

Branch 'die-back', so familiar in Montserrat, is a closely connected, but far less serious trouble. Defoliation occurs, nearly always at the top or on the windward side, and the wood and bark die downwards together. Progress is slow, and often becomes arrested at the point of emergence of a branch or a bud lower on the trunk, or it may be stopped by callus and gum at any point. The condition is followed by extensive re-shooting from the base.

Records of root disease are quoted, which show clearly that the condition is identical throughout the Lesser Antilles. Briton-Jones in 1928 concluded in Dominica that neither *S. repens* nor the other fungi present were primary parasites [loc. cit.], the trouble being due, probably, to other factors and this view was supported by Ashby in 1929 [ibid., ix, p. 20], and by Baker (in St. Lucia) in 1938 [ibid., xvii, p. 671].

The author carried out a series of inoculations into living roots of seedling limes at a depth of about 6 in., using *S.* [*repens*] and other fungi from dead lime wood; he also inserted slips of diseased or gummed bark and the exudate occasionally found in subcortical blisters under the trunk and root bark of apparently healthy trees, on a hillside in St. Lucia where dying-out had recently been present. No positive result was obtained. Furthermore, young seedling limes (2 to 3 years old) which had failed in a light soil area in St. Lucia or showed typical 'root disease' symptoms in Montserrat were dug up and found to show the presence of no

parasitic fungus at all. Evidence was also obtained which clearly demonstrated that 'root disease' had no connexion with *Diaprepes* spp.

Further work brought to light the fact that the conditions under which 'root disease' appeared in the different islands conformed to a pattern. It occurred first, or at an early age, on light, and later on heavy soils. Dry areas died out before moist (but not very wet) ones, and exposed places before sheltered ones. It appeared that the trees died first in parts where water loss by transpiration was high and soil moisture low or fluctuating markedly from season to season. Data obtained in a survey and by other means showed that survival of seedling limes is possible only if three of the following factors are wanting: (1) low dry-season atmospheric humidity, (2) low available soil moisture in the dry season, (3) an unaerated or generally waterlogged soil, (4) severe wither-tip in the wet season.

Next, a main root on each of five trees was exposed to the extremity, and allowed to dry out on the soil surface, to provide the conditions arising when all the fibrous roots feeding a main root die. The treated roots died, and strip formation began. By the end of 1938 one strip had spread from the root to a point 8 ft. above the ground, and by April, 1939, it had extended along all the branches in its sector, advance occurring at the rate of 8 in. a month, at least 6 ft. being formed in the wet season or during dry periods in the wet season.

The author's interpretation of the known facts is as follows. The internal water supply of the trees is, at least for substantial periods, near the lower limit of adequacy. During the dry season water losses are periodically severe, all water movement occurs along the transpiration stream, and lateral diffusion is at a minimum. When one of the larger roots dies, water is unavailable for another part of the trunk, and permanent injury is done to the dry section, where gumming occurs in the vessels, followed by drying of the wood, and death of the protoplasm in the overlying cambium and cortex. When these tissues have shrunk and dried, a dead strip forms. In the wet season the water loss is smaller, and diffusion of water is possible. Hence, a root exposed and insulated from the soil in the wet season may be sustained by the rest of the root system, with the result that there is no dying upwards. The death of the rootlets cannot as yet be attributed to any cause but lack of water. Search for pathogenic organisms invariably gave negative results.

The author considers that seedling limes can again be successfully established in areas where the four factors mentioned above are absent, and perhaps where only three are absent. The right conditions are present where there are light overhead shade, a well-drained, not too light soil, and an even underground water table or water supply. Until the process by which the fibrous rootlets are killed has been determined, there must be some risk in any such planting project, but if limes budded on a suitable stock are used, such risk is eliminated.

SALGADO (M. L. M.). **Note on physiological stem bleeding of mature Coconut palms.**—*Trop. Agriculturist*, xcviii, 2, pp. 31–35, 1942.

An account is given of some previously undescribed forms of physiological stem-bleeding of coco-nut palms in Ceylon. On two estates the condition was observed to follow manuring. In the first case observed many years ago the 50-year-old trees had received a mixture consisting of 2 lb. cyanamide, 4½ lb. bone meal, and 1½ lb. muriate of potash. In the second, noticed in 1940, 40-year-old palms had received 6 lb. sulphate of ammonia, 4 lb. saphos phosphate, and 3 lb. muriate of potash per palm. Manuring was followed by prolonged drought, which was interrupted by a heavy south-west monsoon in May and June. Bleeding began towards the end of July and affected 85 out of 384 palms. The reddish-brown, circular, superficial patches reached a diameter of 2 or 3 in. and started 2 or 3 ft. from the base. They spread spirally upwards to a distance of about half the length of the stem. It is considered that the bleeding may have been due to excessive sap formation pro-

duced by the sudden absorption of a large supply of nutrients as a result of rains following drought.

Two distinct types of bleeding were due to heavy rains following prolonged droughts with rise of water table. One type occurred after floods, and was more serious than the cases mentioned before. It developed in January, 1939, on rather heavy soil with badly drained impermeable clay subsoil inundated during periodical floods. The patches were reddish-brown, more extensive than in the cases already mentioned, and reached a greater height on the stem. The affected tissues extended to a depth of about an inch, and spread spirally in the path of the vascular bundles.

A second extremely severe, often fatal, type was noted on land with a fluctuating water table, in three areas of the Northern Province, all characterized by low rainfall and long droughts. The patches were reddish-brown and extensive, starting near the base of the trees, and almost reaching the crown. From the bleeding point the patches spread down to a distance of almost a foot. Several apparently healthy, mature palms succumbed to this type of bleeding, which increased in prevalence towards the end of the wet season.

As remedial measures the author recommends that diseased parts be excised and the cuts tarred over, that drains be cut in order to lower the water table during the rains, and that husks be buried in a circular trench round the base of the palm in order to retain moisture during drought.

Niño (F. L.). **Ulcera micótica de córnea (estudio micológico de una observación).** [Mycotic ulcer of the cornea (mycological study of an observation).]—*Prensa méd. argent.*, xxx, 18, pp. 797–806, 14 figs., 1943.

A fungus tentatively identified as *Sporotrichum fonsecai* Pereira was isolated from an ulcer of the cornea in a 62-year-old male patient at the Surgical Clinic, Buenos Aires. Its macroscopic characters on a number of standard media are fully described. In hanging drop cultures on Sabouraud's glucose agar at 25° C. the hyaline, irregularly septate, straight or slightly flexuous, profusely branching hyphae, 1 μ or upwards in diameter, contain numerous fat globules, and bear many ellipsoid to fusiform, Gram-positive spores, 3 to 5 by 1 μ, with rounded extremities. The spores either arise directly in groups from the fertile hyphae or are borne, three or four at a time, at the apex of a kind of phialid. Intercalary chlamydospores develop in older cultures. *S. fonsecai* acidifies glucose, galactose, levulose, and maltose, coagulates milk, and partially hydrolyses starch.

Volk (R.) & Cañas (E.). **Un caso de blastomicosis.** [A case of blastomycosis.]—*Medicina, Méx.*, xxii, 426, pp. 615–623, 7 figs., 1942.

The fungus isolated from the lesions of vegetative ulcers in a 33-year-old male patient in Mexico, D[istrito] F[ederal], was identified by A. Gonzalez Ochoa, of the Mycological Laboratory, Institute of Tropical Diseases, as a species of *Geotrichum* differing from those listed by Dodge in his 'Medical Mycology' [*R.A.M.*, xv, p. 368]. It was cultured on a number of standard media, solid and liquid, at 27° and 37° C., forming on Sabouraud's 2 per cent. glucose agar discoid, salient, waxy, adherent, membranaceous to coriaceous, radially rugose, ivory-coloured colonies, and straight or undulating branching hyphae, 3 to 30 by 3 to 6 μ, dissociating into arthrospores which converge in broken lines and sometimes terminate distally in a long, slender spiral filament. The fungus did not ferment any of the sugars tested, but it produced acid in glucose, galactose, saccharose, maltose, and fructose; gelatine was not liquefied or milk coagulated. Positive results were obtained in inoculation experiments on white rats, from which a fungus identical with the one under discussion was reisolated.

NATTRASS (R. M.). **The pasmo disease of Flax in Kenya, Sphaerella linorum Wollenweber.**—*E. Afr. agric. J.*, viii, 4, pp. 223–226, 1 pl., 2 figs., 1943.

The diseases from which flax has suffered in Kenya during the last 20 years are, in descending order of importance, rust (*Melampsora lini*) [*R.A.M.*, xvi, p. 796], wilt (*Fusarium* sp.) [cf. ibid., vi, p. 533], and stem-break or browning (*Polyspora lini*) [ibid., iii, p. 443]. In recent years the importation of flax seed into Kenya has been allowed only from the British Isles, and as pasmo disease (*Sphaerella linorum*) is not present in Britain, it is remarkable that a sudden, widespread epidemic should break out in Kenya in 1941 [ibid., xxi, pp. 5, 352, 418; xxii, p. 168], apparently the first record from Africa. Linseed has, doubtless, been imported into Kenya from America at some time or other between 1922 and 1942 and the fungus may have been introduced at any time during this period, persisting unnoticed until suitable climatic conditions for an epidemic outbreak occurred. In this connexion it is noteworthy that exceptionally prolonged wet periods were experienced during 1941–2. On the other hand, it is possible that pasmo disease may have been introduced with recent military and other shipments from America.

Under the conditions prevailing in Kenya infected straw and crop debris are the most probable sources of infection. There is little doubt that pycnidia and spores can remain viable from one crop to another. It is not certain that seed transmission is usual in Kenya. Seeds from a badly infected 1941 crop produced plants with no sign of the disease, and when tested by the Ulster method [ibid., xx, p. 261], failed to produce any growth of the fungus; neither was the organism found in centrifuged washings of the same seed. Pending further investigations, however, it is safest to assume that in Kenya, as elsewhere, *S. linorum* is carried by the seed. Small particles of infected material may carry pycnidia and dried spore masses, which remain with the seed after cleaning.

Flax should not be grown on land which carried flax the season before. Seed from an infected crop should not be sown. The movement of seed and straw from infected areas should be controlled, and fresh outbreaks notified at once. Field sanitation is important; straw and stubble in the case of linseed, and crop debris in that of flax, should, if the crop is diseased, be destroyed. Seed treatment with agrosan or ceresan U is recommended. The two varieties grown in Kenya, Liral Crown and Stormont Gossamer, appear to be equally susceptible.

MUSKETT (A. E.) & COLHOUN (J.). **The prevention of seed-borne diseases of Flax by seed disinfection.**—*Ann. appl. Biol.*, xxx, 1, pp. 7–18, 1 pl., 1943.

In this paper the authors give a full account of work carried out in Northern Ireland from 1939 to 1941, inclusive, on the prevention of seed-borne diseases of flax (chiefly stem-break and browning due to *Polyspora lini* [*R.A.M.*, xxi, p. 489], and seedling blight caused by *Colletotrichum lini* [loc. cit.]) by seed disinfection. Suitably infected seed samples were selected by the Ulster method [loc. cit.], and a laboratory technique was devised which permitted a rapid evaluation of materials likely to prove useful as seed disinfectants.

Formaldehyde proved ineffective or phytocidal, cuprous oxide was of no use, and the results obtained by the dusting method indicated that the use of organo-mercury powders at dosages comparable with those effective for cereals was unsatisfactory. The short liquid method was then tried, using ceresan (U. 564), at 2, 4, and 8 per cent. solution, applied at 20, 30, and 40 c.c. per 500 gm. The method was superior to the dry one, and very promising results were given by the 8 per cent. solution at 30 or 40 c.c. In 1941 the fixation method was used, in which the dust is fixed to the seed by the use of water or separated milk. Ceresan (1875 A) was selected for the test. In the first place the seed was treated with the powder by the usual method at the rate of 3 gm. per 500 gm. of seed. Afterwards the seed was treated with water or separated milk at the 40 c.c. rate. The results of the fixa-

tion method showed marked improvement over those given by the dry treatment at twice the dosage, and were comparable with those of the short-liquid treatment using an 8 per cent. solution of an organo-mercurial applied at the 40 c.c. rate. Both water and milk were equally satisfactory.

In 1940 and 1941 tests were made with 'nomersan', a non-poisonous white powder containing tetramethyl thiuramdisulphide as its active constituent, manufactured by Imperial Chemical Industries, Ltd. [ibid., xx, p. 535]. This was used at 1·5, 3, 3·35, and 6 gm. per 500 gm. The promising nature shown by this material in preliminary laboratory tests was confirmed in field trials. Its action was selective; applied at the 3 gm. rate, it almost eradicated *C. lini* from infected seed, but its effect on *P. lini* was not very satisfactory, being less than that of organo-mercury powders used at the 6 gm. rate. The same selectiveness was observed in the suppression of mould growth on seeds; its bactericidal qualities were poor. No additional advantage accrued by using the fixation method with nomersan. All flax seed sown in 1941 and subsequently has been treated with nomersan at a cost of 2*s*. 6*d*. per acre.

In the case of stem-break and browning almost all the seed treatments significantly increased the crop weight. In 1940 the best treatments produced crops of over 2·5 tons per acre, as compared with 1·65 tons for the untreated controls, while in 1941 the corresponding figures were 2 and 0·8 tons respectively. Only the most promising treatments significantly increased fibre yield; in 1940 they gave about 3·75 cwt. per acre, as against 2·5 cwt. for the controls, the corresponding figures for 1941 being 1·76 to 1·91 and 0·41 cwt., respectively. The explanation why a significant increase in fibre yield did not result whenever the crop yield was increased is that where treatment was only partially effective and allowed browning to spread, some of the fibre was injured.

The case of seedling blight is different. In neither 1940 nor 1941 did seed treatment give a significant increase in crop weight, but in both years the best treatments significantly increased fibre yield, the figures being about 6·25 as against 5 cwt. The suggestion is made that the higher fibre yields may have been due to the production of a more even crop of healthy plants from the treated seed.

Tentative methods of test for resistance of textile fabrics to microorganisms.—*A.S.T.M. Stand., 1942*, pp. 59–62, 1942.

Two procedures are proposed by the Committee D–13 on Textile Materials of the American Society for Testing Materials in connexion with the testing of canvas, duck, and similar fabrics designed for outdoor use, viz., (1) an accelerated mildew infection test in which the material is incubated with a stock culture of *Chaetomium globosum* [*R.A.M.*, xxii, p. 73], and (2) a soil burial test, involving the burial of specimens of the fabrics for six weeks in soil containing an abundance of cellulose-destroying organisms maintained at a temperature of $90° \pm 5°$ F. at a depth of 1 in. below the surface. The visible effects of the experimental processes on the materials are observed and loss in strength determined.

Caldwell (J.) & Prentice (I. W.). **An investigation into the 'stripe' disease of Narcissus. II. Experiments on the virus agent and its spread.**—*Ann. appl. Biol.*, xxx, 1, pp. 27–32, 3 figs., 1943.

Further investigations into narcissus stripe [*R.A.M.*, xvii, p. 603] showed that chlorosis is the commonest reaction to infection in the field. It is most conspicuous when the leaves are 3 to 4 in. long. Warm weather seems to cause masking of this symptom. Proliferation frequently occurs, and is not masked by high temperatures; it takes the form of an outgrowth of the mesophyll tissues under or through the epidermis. In the field it becomes increasingly plain in mid-season. Distortion accompanied by severe local chlorosis was noted in certain varieties but its

incidence and severity were variable. Some varieties, particularly Beersheba, Damson, Bath's Flame, and Sunrise show leaf corrugation.

In September, 1937, in order to study the manner of spread of the disease in the field, two plots of healthy bulbs were prepared, and rows of diseased bulbs were planted round them. One plot was sprayed with an insecticide during the season 1937–8. The other (unsprayed) was enclosed in a wooden frame sunk into the ground for about 2 ft. and not protruding from it. In 1938–9 the plots showed 3 and 14 per cent. disease, respectively, from which it was concluded that the transmission of the disease takes place above ground and not through the roots. This conclusion received further support from more extensive experiments with the variety Sir Watkin.

When sorted according to weight, as compared with the healthy bulbs a larger proportion of infected bulbs fell into the lower-weight classes, and a smaller proportion in the higher-weight, suggesting that the infected bulbs multiplied less rapidly and produced smaller daughter bulbs than did the healthy ones. Further work demonstrated that the flower stalks of healthy plants were slightly longer than those of diseased ones, and the flowers on healthy plants matured a few days before those on diseased plants.

No evidence was found of seed transmission in hundreds of seedlings studied but the virus was successfully transmitted by bulb grafting (18 out of 18 graft unions) and by juice inoculation with the use of an abrasive such as carborundum (about 15 per cent. successful). Inoculations into Tresserve produced symptoms of the Tresserve type, whatever type of symptom was shown by the variety used as the source of inoculum, indicating that the agent is a single virus and not a complex, as previously suggested [loc. cit.]. Juice from hyacinth, crocus, iris, and tulip infected with mosaic did not produce infection in narcissus. When tulip plants were treated with the juice of narcissus plants severe lesions developed on the tulip leaves, and when grafts between the two plants were attempted the tulip bulb succumbed.

Careful roguing at frequent intervals is recommended for controlling the spread of the disease.

Creager (D. B.). **Carnations attacked by wilt on coast and midwest.**—*Flor. Rev.*, xci, 2348, pp. 13–15, 1942. [Abs. in *Biol. Abstr.*, xvii, 4, pp. 1089–1090, 1943.]

Pseudomonas caryophylli, reported from Washington, Illinois, Iowa, Indiana, and Missouri, develops rather suddenly on carnations, causing a grey-green, later tan or brown wilting of the top or branches, accompanied by a yellowish to brown internal discoloration of the stem, softening of the cortex of the stem base, and a sticky consistency of the inner wood. Infection is most severe during warm periods in the late spring, summer, and early autumn. The pathogen may be combated by the following sanitary measures: selection of cuttings from healthy plants and immersion of the former in a solution of potassium permanganate (1 oz. in $7\frac{1}{2}$ gals. water) before insertion in the propagation bed, soaking in water alone being inadvisable; steam sterilization of propagation media and bench, of soil, pots, and flats for starting new plants after rooting, and of soil and bench for growing on; and a three- to five-year rotation for field plantings.

Weimer (J. L.). **A Botrytis disease of Lupines.**—*Phytopathology*, xxxiii, 4, pp. 319–323, 1 fig., 1943.

A fungus identified as a member of the *Botrytis cinerea* group on the basis of its morphological and cultural characters was observed to cause a stem and branch canker of lupins (*Lupinus angustifolius*) at Tifton, Georgia, and to a lesser extent at Gainesville, Florida, in February, 1938, following a January freeze. The affected areas are frequently girdled and the parts above them killed. The results of inocu-

lation experiments showed that freezing was not essential to infection, but the tissues thus damaged appear to provide an easy channel of ingress for the pathogen. Good growth was made on a number of standard media, including potato dextrose (2 per cent.) agar, though fruiting was very sparse except on oatmeal agar on a long slant in a large test tube, on which the mycelium ranges from 8 to 12·6 μ in diameter and the spores measure 8·4 to 13·6 by 6·8 to 10·5 (average of 50, 8·2) μ. The disease under observation is evidently the same as that previously reported from New Zealand [*R.A.M.*, ii, p. 504], Germany [ibid., vi, p. 732], and South Africa [ibid., x, p. 602]. General precautionary measures against infection include rotation, avoidance of wet areas, not too thick sowing, and the use of the hardiest varieties available.

MARENGO (L. V.). **Fusariosis del Girasol (Helianthus annuus L.).** [Fusariosis of the Sunflower (*Helianthus annuus* L.).]—*Rev. Fac. Agron., B. Aires.*, x, 1, pp. 130–147, 9 figs., 1942. [English and Portuguese summaries.]

Fusarium solani var. *minus* was isolated on potato glucose agar from diseased sunflower plants at the University of Buenos Aires and its cultural and morphological characters are fully described. The disorder develops on 7- to 20-day-old plants under two forms, viz., (1) wilt, accompanied by collapse of the tissues and causing a gentle downward bending of the stem, and (2) damping-off. An examination of the root system reveals the presence between the collar of the hypocotyl and its first rootlets of sunken, necrotic lesions, which may entirely girdle the stem and in some cases penetrate to the medulla.

Of three methods of inoculation tested, the most effective consisted in the application to each sunflower seed sown of fragments of sterilized seed bearing the developing mycelium and spore of the pathogen. The infected plants contracted damping-off symptoms within a period ranging from a week to a month from germination.

A brief review is given of some previous contributions to the knowledge of sunflower diseases, from which it appears that *F. solani* var. *minus* has not yet been recorded as a pathogen of the host in question. A bibliography of 44 titles is appended.

KOLK (LAURA A.). **Germination of grass smuts.**—*Amer. J. Bot.*, xxx, 4, pp. 317–330, 39 figs., 1943.

The following observations were made from germination studies of seven smuts of wild grasses and from comparisons with seven well-known cereal smuts. *Ustilago underwoodii* on *Panicum virgatum* germinated rapidly, producing abundant conidia from a short stub or projection of the protoplast from the spore wall, commonly without forming a promycelium, although the conidia may become septate and also increase by budding. It did not develop a mycelium, being in this respect similar to *U. bromivora*, *U. hordei*, and *U. avenae*, all three of which produce abundant conidia usually from short promycelia. *U. togata* on *P. dichotomiflorum* produced abundant conidia but also tended strongly to form long hyphae, either in place of a promycelium or in addition to it, frequently producing both types from the same spore. The growth of the emerging protoplast is less checked in this species than in the smuts mentioned above. The same development occurs in *Sphaceloma sorghi*, *S. holci*, and *S. cruenta*. *U. hypodytes* on *Stipa californica*, *S. occidentalis*, *Distichlis stricta*, *Elymus condensatus*, and *Agropyron trichophorum* frequently produced conidia on tips of branches growing out of promycelial cells, although abundant promycelial conidia also developed at times; consequently there was less check upon the growth of the emerging protoplast. All collections of this smut formed mycelial mats either directly from the spore or from conidia and bore aerial conidia. *Sorosporium syntherismae* on *P. dichotomiflorum*, *U. rabenhorstiana* on

Digitaria sanguinalis, and *D. ischaemum*, and *U. neglecta* on *Setaria lutescens* germinated slowly and showed a strong mycelial tendency with little check upon the growth of the germ-tube, giving rise to a long, more or less non-septate hypha or a mass of branching hyphae. Aerial conidia were observed in *Sorosporium syntherismae*, and aerial mycelium in *U. rabenhorstiana* and *U. neglecta*.

The author stresses the necessity for great caution in naming new species of smuts or renaming old ones. Careful experimentation should be conducted previous to identification and the following taken into account: (1) morphological characters associated with disease manifestation on the host, and the effect on the general habit of growth of the host; (2) spore characters and the type of germination based on data from repeated trials conducted over a sufficiently long period; and (3) infection capacity of the smut on a number of hosts. Previously described smuts, the typical form of which is not completely studied, should not be used for placing new forms. For this reason the author hesitates to accept *U. bullata* in place of *U. bromivora*, and also suggests that further experimental work is necessary to fit *U. perennans* into the picture of the known physiologic races of *U. avenae* before deciding on a change in nomenclature as proposed by Fischer and Holton [*R.A.M.*, xxi, p. 11].

BERNSTEIN (P.) & MARSHALL (R. E.). **A study of internal breakdown of Northern Spy Apples in storage.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxv, 2, pp. 156–162, 3 figs., 1942.

Various combinations of manurial treatment, fruit-thinning, and irrigation practices were applied to 20 23-year-old Northern Spy apple trees to determine the relation of these factors to internal breakdown in storage.

The most important fact established by the investigations was the failure of fruits upwards of 3½ in. in transverse diameter to escape breakdown during the ordinary commercial storage season, the abnormal condition developing after about two months at 32° to 33° F. or even earlier at higher temperatures. It is therefore recommended that a fractional picking of apples likely to attain the critical dimensions should be made some ten days before the usual commercial picking, and the fruits exceeding 3 in. in diameter stored in sacks that can be transferred from storage to the consumer before mid-December. Where two pickings are impracticable, harvesting should be carried out at the usual time and the fruits divided into two grades, those of 3½ in. and upwards being stored for a period not exceeding eight weeks, while the remainder may be kept at 32° until March if desired.

The storage season for large, susceptible fruits may be appreciably prolonged by storage at 40° in rooms equipped with facilities for the maintenance of a concentration of 5 to 10 per cent. carbon dioxide in the atmosphere. The writers do not advocate attempts to regulate the size of the apples by cultural methods except the avoidance of overhead irrigation in seasons of light bearing.

WILCOX (J. C.) & WOODBRIDGE (C. G.). **Some effects of excess boron on the storage quality of Apples.**—*Sci. Agric.*, xxiii, 6, pp. 332–341, 3 figs., 1943.

Two types of fruit injury were induced or aggravated by excess of boron in apples from trees previously suffering from boron deficiency in British Columbia. Both developed in storage, one in the McIntosh variety, the other in Jonathan. In the former the primary bundles midway between the carpel points turned brown, the discoloration spreading outwards along the core line, and affecting the area round the core ring; the flesh also became discoloured round the stem cavity. In the latter typical water core and flesh breakdown symptoms were increased by excess boron. A lowering of the storage quality may occur without any evidence of leaf or twig injury and only with the heaviest applications was the injury severe enough to render the fruit unmarketable. A highly significant positive correlation was

obtained between the amount of boron applied to the soil and the boron content of the fruit (both varieties), and also between the boron content of the fruit and the flesh breakdown of Jonathan. When the season is conducive to fruit injury, this injury is more likely to occur and to be commercially detrimental when the boron content is higher than 24 p.p.m. of the dry weight, and in such seasons the optimum content for the fruit may fall within the narrow limits of 10 and 20 p.p.m. Seasonal differences and amount of crop affect the degree of injury to the fruit, for in 1939 no apparent injury occurred on the Jonathans, whereas in 1938 and 1941 the heavier applications induced severe water core and flesh breakdown.

Storage troubles aggravated by excess boron may occur when boron is not present in excess. In 1941 storage breakdown affected 17 per cent. of the fruit from a tree which had received only 6 oz. of borax in six years. Other evidence suggested that even fruit from trees not treated with boron compounds might become affected by severe water core and flesh breakdown.

In 1938 boron contents over 24 p.p.m. were found in fruits from one tree given 32 oz. of boric acid three years before, from two trees given 64 oz. three years before, and from six trees given 8 oz. or more of borax or boric acid annually for three years. In 1939 the high-boron fruits came from two trees given 64 oz. four years before, and from nine trees given 8 oz. or more annually for four years.

The data indicate that deleterious effects on the storage quality of apples are possible when more than 32 oz. boric acid or its equivalent is applied to a tree in any one year, or when 8 oz. or more are applied annually. This finding is not necessarily applicable to other conditions than those obtaining in the authors' studies.

LYCKÅS (C.). **Skador på lagrad frukt.** [Damage to stored fruit.]—*Fruktodlaren, Stockh.*, *1941*, 6, pp. 175–178, 5 figs., 1941.

Notes are given on the principal causes of damage to stored apples in Sweden, viz., green mould (*Penicillium glaucum*), the commonest and, generally speaking, most destructive of all parasitic storage diseases, capable of further development at 0° C., though a fairly high temperature is requisite for initial infection; grey mould (*Botrytis cinerea*), also resistant to the low temperatures maintained in cold-storage plants; late scab (*Venturia inaequalis*), brown rot (*Sclerotinia* spp.), *Gloeosporium* rot (*G. fructigenum* [*Glomerella cingulata*], and *Gloeosporium album*), core fusariosis (*Fusarium avenaceum* and *F. lateritium*), which is prevalent chiefly on varieties with long, open stylar tubes (the channels of infection), e.g., Åkerö, and extends outwards into the flesh at a temperature of 15° upwards or otherwise adverse conditions; bitter pit, one form of which, reminiscent of *Lygus* injury, especially on Charlamowsky, is at any rate associated with boron deficiency [*R.A.M.*, xx, p. 412]; and physiological disturbances due to chilling, freezing, and over-maturity.

These diseases may be combated by strict attention to orchard sanitation, careful sorting, and the provision of a cool (but not freezing), moderately damp place of storage (relative humidity 85 to 95 per cent.), which should be thoroughly cleansed and fumigated with sulphur at the rate of 4 gm. per cu. m. before use. During storage care should be taken that apples are equally spaced and all infected or over-ripe fruits eliminated as quickly as possible.

CATION (D.), BOYER (C. A.), & ROBERTSON (C. W.). **Red stele root rot of Strawberries.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxv, 3, pp. 235–242, 2 figs., 1943.

Red stele root rot of strawberries (*Phytophthora fragariae*), first observed in Michigan (Berrien County) in 1937, is now regarded as the most serious disease affecting the crop in the State. The present system of inspection and handling of strawberry plants in the early autumn of the first growing season does not permit the ready detection of traces of infection, and new arrangements for certification

for apparent freedom from red stele have accordingly been made by the Department of Agriculture. Two inspections will be made during the first season of cultivation, one in early June, when the characteristic symptoms are most apparent, and the second at the beginning of November, when the above-ground manifestations of the disease should be recognizable. On the basis of the latter findings, the certification of suspected plants will be withheld until the early May examination, when confirmatory symptoms will have developed.

ALENCAR (J.). **Notas sobre o entomosporiose na Ameixa Amarela (Eriobotrya japonica Lindl.).** [Notes on entomosporiosis of the Loquat (*Eriobotrya japonica* Lindl.).]—*Ceres, Minas Geraes*, iii, pp. 117–120, 2 figs., 1942.

This is the first report of *Entomosporium maculatum* [*Fabraea maculata*] on the loquat in Minas Geraes, Brazil, though the same host is often severely attacked in São Paulo [*R.A.M.*, xix, p. 30]. Control may be effected by spraying the plants, during the production of new growth, with 1 per cent. Bordeaux mixture plus a casein spreader.

MONTGOMERY (H. B. S.) & SHAW (H.). **Behaviour of thiuram sulphides, etc., in spore germination tests.**—*Nature, Lond.*, cli, 3829, p. 333, 1943.

About seven years ago the authors observed that in certain tests the toxicity of tetramethylthiuram monosulphide to the spores of *Venturia inaequalis* decreased as the concentration of the fungicide increased [cf. *R.A.M.*, xxi, p. 72]. The same effect was noted with tetramethylthiuram disulphide. It is now reported that this property of 'inversion of toxicity' is shared by other thiuram sulphides and some dithiocarbamates, namely, dimorpholyl thiuram monosulphide, dipentamethylenethiuram mono- and disulphides, sodium diethyl-dithiocarbamate, sodium and zinc morpholyl-dithiocarbamates, and sodium and piperidine pentamethylene-dithiocarbamates, and is probably a general property of these groups, which has remained unnoticed in some cases because the range of concentration within which it occurs has not yet been located. It is thought that the explanation of this behaviour may most likely be found in the chemical reactions of these notoriously labile substances.

MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 20–23, 1943.

Fusarium moniliforme [*Gibberella fujikuroi*] was isolated from maize seedlings grown by a London commercial firm in nutrient solutions, on which mould had been observed to develop. Washing the seed well with water and soaking it in a solution of potassium sulphide (½ oz. per gal. water) for 16 hours retarded, but did not prevent, mould development. On the other hand, heating the previously soaked seed to a temperature of 54° C. for 20 minutes successfully eliminated *G. fujikuroi*, although it had little or no effect on the subsequent development of *Penicillium* in the sprouting cabinets.

A species of *Penicillium* was isolated in 1941 from lesions and rotted tissue of bulbs of *Scilla patula excelsior* and *S. hispanica alba* grown in Buckinghamshire. The rot, which affected some 10 per cent. of a total of 8,000 bulbs, was characterized by large, lateral, sunken lesions up to ¾ in. across, often coalescing, although occasionally the basal plate only was affected. The diseased areas were frequently completely covered with a copious growth of the fungus or, in its absence, the lesions were pale brown and the outer skin puckered into yellow folds or blisters. In some bulbs the rot was superficial, extending only about ⅛ in. in depth, the collapsed cells forming a buff-coloured, spongy layer; in others it was wet, soft, dark brown, and deep. The pure culture of the isolated fungus, which produced numerous very characteristic blood-red drops on Czapek's agar, was identified by G. Smith as a strain of the *corymbiferum-hirsutum* group. These two forms are

regarded by Smith, in accordance with Thom's opinion, as different strains of the same species. The original description of *P. hirsutum* Dierckx (1901) is, according to Thom, worthless, but since an adequate description, apparently based on authentic material, was later supplied by Biourge (1923), it is suggested that the correct name for the fungus in question is *P. hirsutum*, despite the fact that *P. corymbiferum* Westling (1911) antedates Biourge.

Examination of a few diseased bulblets of white garlic sent to the author in 1942 by C. J. Hickman from a consignment from the Argentine, showed that the symptoms of the disease and the characters of the fungus growing on the surface of lesions agreed closely with the disease caused by *Helminthosporium allii* in Italy [*R.A.M.*, iv, p. 325]. The unidentified species of *Pleospora* found in Italy on plants attacked by *H. allii* was not observed on the diseased material examined.

MOORE (W. C.). **The measurement of plant diseases in the field. Preliminary report of a sub-committee of the Society's plant pathology committee.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 28–35, 1 fig., 1 graph, 1943.

Over 1,200 estimates of disease intensity were received in 1941 by the sub-committee of the British Mycological Society's Plant Pathology Committee, in response to its appeal to various plant pathologists to collaborate in testing the methods of recording disease quantitatively in the field, proposed by the sub-committee for standardization. Observations were invited on six diseases important in war time, namely, loose smut of wheat [*Ustilago tritici*], blight (*Phytophthora infestans*) and virus diseases of potato, virus yellows and downy mildew [*Peronospora schachtii*] of sugar beet, and brown rot [*Sclerotinia fructigena*] of apple, and also on take-all (*Ophiobolus graminis*) and eye spot (*Cercosporella herpotrichoides*) of wheat, and apple scab (*Venturia inaequalis*). The same general procedure was recommended for potato, sugar beet, and wheat: two traverses to be made and ten samples taken on each traverse, one sample of potato or sugar beet consisting of ten consecutive plants in a drill (the ten samples to be taken at convenient distances along the diagonals of the field) and one of wheat consisting of two 1 yd. lengths of drill row, consecutive but in adjacent rows. To avoid unnecessary damage to the crops, the traverses were to be made in the direction of drilling instead of along the diagonal, beginning from the side of the field at points $\frac{1}{5}$ and $\frac{4}{5}$ of the width of the field, taking the first sample not less than 15 paces from the edge of the field, the observer side-stepping three paces after each sample and then proceeding along the row to the next sampling place. With all diseases except potato blight it was considered sufficient to record the numbers of infected and healthy plants or tillers in each sample; for potato blight each plant in the sample was to be given a symbol from 0 to 6, depending on the number of spots present on the leaflets or, at the higher levels, on the amount of leaf area destroyed. Brown rot of apple was to be recorded about a fortnight before harvest, taking a count of the number of affected apples among 50 fruits chosen at random from each of ten trees taken at random. Apple scab observations were to be carried out in July, collecting a minimum of 500 leaves by picking 50 at random from each of 10 trees scattered through the orchard, the leaves to be graded by means of the Tehon scale.

The results showed that the earliest record of potato blight was from Cornwall (28th July). From the records obtained it was possible to list potato varieties according to their susceptibility to blight. It was also shown that, in general, blight was slightly worse on crops grown from once-grown English seed than from fresh Scotch.

On the basis of experience obtained during 1941, the sampling methods were modified in many respects. The number of disease categories were reduced; only crops with more than 1 per cent. of disease needed to be sampled; and, in addition, rapid visual methods for determining this level were proposed. It is hoped that

observations made during 1942 will give further indications of possible improvements towards evolving standard methods of sampling.

BISBY (G. R.) & AINSWORTH (G. C.). **The numbers of fungi.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 16–19, 1943.

The authors give the approximate number of genera and species of fungi described up to 1940 [cf. *R.A.M.*, xii, p. 579], indicating the numbers accepted as good by competent authorities. The grand total of all good species amounts to 37,500, but it is suggested that this figure, although fairly conservative, is still too large in two respects: (1) a third of the Fungi Imperfecti have probably named perfect stages (proved or unproved, known or unknown), and (2) many species are not based on morphology alone, but on their hosts as well. It is estimated, therefore, that the total number of known good species is about 34,000, of which about 25,000 are based on morphology. The number of species known is estimated to represent about one-third of all existing fungi, of which there are probably about 100,000. The total number of genera proposed up to 1940 exceeds 7,000, 47·2 per cent. of which are monotypic. It is suggested that probably not more than one out of two proposed new genera, and not more than one out of three new species, is valid, and it is felt that a competent study of old genera and species, with much elimination, is badly needed. The number of species of fungi (including Myxomycetes) recorded from Britain is 9,000, out of which about 6,000 are considered good. It is suggested that a new enumeration of British Fungi be started, based only on such specimens as can now be found, definitely identified, and preserved in available herbaria.

KEN KNIGHT (G.). **Studies on soil Actinomycetes in relation to Potato scab and its control.**—*Tech. Bull. Mich. agric. Exp. Sta.* 178, 48 pp., 1941. [Received May, 1943.]

Of the numerous inorganic and organic chemicals tested on heavily infested soils in Michigan for potato scab (*Actinomyces scabies*) control, none gave promise of practical utility and the mercury compounds even seriously aggravated the trouble in a number of experiments. Investigations were then carried out to determine the cause of the conflicting results reported in the relevant literature on the effect of mercury compounds as soil treatments on potato scab. The trials comprised field and pot soil treatments, studies on the relative tolerance of *Actinomyces* from different sources of mercuric chloride in nutrient solutions, dilution-plate counts of micro-organisms from mercury-treated soils, and observations on factors affecting the evolution of mercury vapour from compounds of the chemical by the use of a test organism (*A.* No. 6 from eggplant) for the detection of minute quantities of the vapour.

The primary reason for the discrepancies in question was shown to lie in the wide variation of the parasitic Actinomycetes in their tolerance of mercury compounds. In a nutrient solution, isolates from England and Long Island, for instance, were less tolerant of mercuric chloride than were similar Michigan strains, some of which withstood a concentration of the compound more than 100 times as high as that required to kill the more sensitive isolates from regions where soil treatments are successful. Calomel [mercurous chloride] controlled scab both in Long Island and local (East Lansing, Michigan) soils artificially infested with Long Island strains, whereas the same treatment caused an increase of infection in both soils inoculated with Michigan Actinomycetes. The data from dilution-plate counts indicated that mercurial soil treatments, in soils infested with local Actinomycetes, effected an initial reduction in the number of the latter, but that those capable of tolerating the chemical subsequently multiplied, presumably as a result of the reduced competition on the part of other micro-organisms.

Mercury vapour apparently reacted with ingredients in the nutrient agar to

produce substances toxic to micro-organisms, but in a dry state, or in pure water, the spores even of the most sensitive *A*. No. 6 sustained no injury from this source. The mixture of powdered zinc with mercury compounds appeared to accelerate the vaporization of mercury from the latter: on the other hand, oxidizing agents, especially potassium permanganate, mixed with mercury compounds reduced the rate of evolution of the vapour. One part of potassium permanganate to 1,000 of yellow oxide of mercury counteracted the lethal effect of the latter on the test organism in sealed containers. This phenomenon could be demonstrated without actually mixing the potassium permanganate with the mercurial or even placing the chemicals in close proximity, the affinity between them operating both in the dry and wet state, as well as in the soil.

The vapour from yellow oxide of mercury easily traversed 6 in. of sandy soil but not loam, clay, or muck, though when 0·1 gm. of the compound was mixed with 25 gm. of loam and covered with 6 in. of loam the vapour came through. The admixture of acids with mercurials prevented the evolution of the vapour. Under field conditions hydrochloric acid (1,500 lb. per acre) applied with mercurous chloride exerted no lasting effect on the soil reaction and none on the tendency of the mercurial to increase scab, which was reduced, on the other hand, by the use of sulphur with mercurous chloride, the former being given time to oxidize.

Mercurous chloride as a soil treatment increased the incidence of scab on beet and eggplant roots, but not on those of radish, turnip, or swede, combinations of lime with the mercurial being more effective than the latter alone in the aggravation of such injury.

In trials over a three-year period 21 bacterial isolates, 41 Actinomycetes, including *A. praecox*, *A. viridis*, and *A. setonii*, seven fungi (*Pythium* sp., *Trichoderma lignorum* [*T. viride*], *Fusarium* [*bulbigenum* var.] *lycopersici*, *Alternaria* sp., *Mucor mucedo*, *Dendryphium* sp., and *Rhizopus batatas*), and two yeasts, added to scab-infested soils on various media, failed to control the disease, significant increases in which were caused by green manures of bluegrass [*Poa pratensis*] and lucerne and other forms of organic matter.

Various difficulties precluded an altogether satisfactory outcome of the pathogenicity tests carried out with pure cultures of Actinomycetes, but apparently several species or races of *Actinomyces* were pathogenic to Katahdin potato tubers, the most virulent being *A. viridis* and the isolates from beet, turnip, and Warba potatoes. The host range of the Actinomycetes concerned in scab production was shown to include eggplant, *Solanum nigrum*, *Brassica arvensis*, and *Amaranthus retroflexus*, and possibly other plants.

A bibliography of 87 titles is appended.

Proceedings of the Association of Applied Biologists.—*Ann. appl. Biol.*, xxx, 1, pp. 80–108, 6 graphs, 3 diags., 2 maps, 1943.

At a joint meeting of the Association of Applied Biologists and the British Mycological Society in 1942, a discussion was held on potato virus diseases. In an introductory paper G. Samuel (pp. 80–82) stated that every year, over 300,000 tons of Scottish and Irish seed potatoes are imported into England, and in two or three years almost the whole of this seed has been discarded. No other form of plant disease causes such tremendous destruction in Britain. Under present conditions, the importation of fresh seed from Scotland and Ireland offers the easiest means of control. The standard of certification was raised in 1937 to permit not more than 0·5 per cent. of leaf roll and severe mosaic, and not over 1 per cent. of all readily visible virus diseases. This has stimulated roguing, many farmers now hiring professional roguers, and in the absence of appreciable insect transmission it has resulted in a definite improvement of stocks. Over 20,000 acres reach this higher grade annually. The highest grade Stock Seed Certificate requires not more than

0·25 per cent. of visible virus disease, with fewer than four plants per acre (about 0·025 per cent.) showing leaf roll or severe mosaic. Some of this highest grade seed is bought by ware growers in England, and planted in counties where it degenerates in a year. Seemingly, it would be more economical to keep the seed in Scotland.

While the position as regards leaf roll and severe mosaic (virus Y) in Scottish and Irish seed is good, it is less satisfactory as regards mild mosaic (virus X) which is present throughout most stocks of certain varieties; in some circumstances it may reduce yields by 16 to 40 per cent. The chief problem now is how to multiply stocks from tested X-free tubers on a large commercial scale.

The other part of the potato virus problem is how to make good seed last as long as possible when brought to England for ware-growing. The rapid degeneration in south-eastern England is almost wholly due to the spread within the stocks of leaf roll and virus Y. The Ministry of Agriculture and Fisheries has instituted a scheme for the certification of 'once-grown' seed. The parent stock must be good Scotch, Irish, English, or Welsh seed-growers' association stock containing under 3 per cent. leaf roll and severe mosaic and over 50 yds. distant from other, affected potatoes [*R.A.M.*, xx, p. 131].

F. C. Bawden (pp. 82–83) dealt with some properties of the potato viruses, leaf roll, X, and Y, of which the first is economically the most important, for while it may cause less reduction in the yield of individual plants than virus Y, it occurs much more often. Some of the relatively unimportant viruses are strains of X and Y, B and D being serologically related to X, and C to Y. In the field it is common for one of the aphid-transmitted leaf roll and Y viruses to spread considerably while the other does not, or for one to spread at one period and the other at another time. These two viruses are responsible for the rapid degeneration of potato stocks in the south and east of England, and seed from Scotland and Ireland is superior because relatively free from them. Except, however, for those varieties that die when infected with the more prevalent strains of X, such seed is generally widely infected with X, which appears to spread as easily in Scotland and Ireland as it does in England.

K. M. Smith described practical difficulties in the production of virus-free seed potatoes (pp. 84–85). He stated that in his work at the Plant Virus Research Station, Cambridge, difficulty is experienced in securing virus-free material of new potato varieties. Another trouble is that virus X is often found in potato plants which have been already carefully tested and have never left the glasshouse.

In tests for viruses in potato plants the author uses tobacco, *Nicotiana glutinosa*, and *Capsicum* plants, which react well to X and Y. For other viruses which are not sap-transmissible he uses grafting and a potato variety that develops conspicuous symptoms of the virus under test. Most testing is done in spring. Insects are kept under control by constant fumigation. Stock maintenance demands unremitting vigilance and routine testing. The real difficulties begin when the attempt is made to multiply glasshouse stocks outdoors. No method of isolation has proved successful. For the present the attempt to multiply the author's virus-free stocks in England has been abandoned, the glasshouse stocks being grown in isolation in Northern Ireland. When sufficient stocks have been built up they will be passed on to the seed trade.

T. Whitehead discussed factors affecting the health of seed-potato stocks growing under a scheme that has been in operation in North Wales for 15 years (pp. 85–96). The evidence obtained during this period demonstrated the value of continuous aphid and virus disease records and proved that an intimate connexion exists between aphid infestation and potato degeneration. It also showed that a national survey along these lines would be justified on both scientific and practical grounds. The author recommends that, in the absence of effective field control of aphids, (*a*) Class 1 Certificates should be confined to good seed-growing areas;

(*b*) a parentage of less than 1 per cent. total virus disease from Class 1 areas only should be required before a stock is inspected for certification; (*c*) stock certification in areas with early and high aphid counts is scientifically unjustifiable; (*d*) deficiencies in good seed stocks available for sale should be made up by encouraging the planting of small ware or chats from the best seed-growing districts: certificates of doubtful value should not be issued to stocks in other, less suitable localities; and (*e*) as a war emergency measure for reducing transport, County War Agricultural Committees should be encouraged to plant good seed in selected areas for use as seed in the county.

P. H. Gregory discussed the spread of potato virus diseases in the field (pp. 104–105). He stated that in 1940 and 1941 the amount of spread round secondary leaf roll plants varied enormously in different fields, even when only a few miles apart, and concluded from his results that the identification and counting of aphids present on a potato crop will not of themselves enable predictions to be made about the health of the progeny. Local factors controlling the movement of the insects are also important. Investigation of the spread of virus between potato fields showed that with increasing distance from a badly diseased stock the amount of virus infection passing over to a healthy stock fell off steeply at first, the curve then flattening out.

In conclusion, G. Cockerham discussed potato breeding for virus resistance (pp. 105–108). Some form of resistance (or tolerance in the case of Y) exists to the viruses X, Y, A, and leaf roll among cultivated varieties of potatoes, and each form is controlled by heritable factors. The possibilities of even more useful forms of resistance in 'wild' material are coming to light, and there is considerable probability that a fair measure of control may result from the introduction of varieties more resistant than those cultivated at present.

Norris (D.) & Bald (J. G.). **Transmission of spotted wilt through Potato tubers.**—*J. Aust. Inst. agric. Sci.*, ix, 1, pp. 34–35, 1943.

In February, 1941, single tubers were harvested from Factor potato plants affected with spotted wilt [*R.A.M.*, xxi, p. 244] in New South Wales. In December of the same year a portion of each was planted in the greenhouse. Of 51 germinated index pieces 16, or 31 per cent., developed symptoms of the disease, the others producing healthy plants. Of the affected plants some collapsed in two or three weeks; four survived for eight weeks or more.

Thirty-three of the indexed tubers from which these plants were grown were set in the field in very dry, hot conditions. Sixteen grew, of which three produced diseased plants which were still living two months after they had been planted.

The evidence thus shows that plants from infected tubers in the field may survive long enough for thrips larvae to acquire the virus, pupate, and emerge as infective adults able to transmit the virus to healthy potatoes. Such plants are a likely source of infection wherever the disease occurs in potato crops. As, however, a generation of thrips must develop on affected plants before transmission can occur in the current season, new infections from these internal sources will not appear for about six or eight weeks after emergence. Symptoms from external sources may develop at any time from about two weeks after emergence, as this is about the incubation period of the virus in the plant.

Tuber transmission in the field is not likely to give rise to many infection centres in a crop from good-quality seed, because the seed tubers showing the typical distortion and cracking caused by spotted wilt would be removed, and of those left only a small proportion would give rise to affected plants. No great reduction in the yield of ordinary table potatoes is likely to result from infection arising from these primary centres within the crop. Heavy losses are experienced locally chiefly in coastal and suburban localities, where garden plants and weeds are present in

abundance. In certification, however, the disease must not be ignored as non-transmissible through the tuber. Diseased plants should be rogued and a maximum tolerance fixed.

BALD (J. G.). **The effect of zinc oxide on the cut surfaces of Potato tubers.**—*J. Aust. Inst. agric. Sci.*, ix, 1, p. 35, 1943.

After pointing out that many materials used to disinfect the cut surfaces of seed potatoes before planting prevent suberization, the author states that when zinc oxide was sprinkled on wet sand on which the exposed surfaces of cut tubers were placed, after a week or more at about 70° F. the surfaces were quite clean, and as well suberized as those of the controls lying on wet sand alone. Other controls on sand wetted with Cheshunt mixture failed to suberize.

In a further test, 2 to 3 cwt. of cut seed tubers of the Up-to-Date variety were treated by dipping the exposed surfaces in a suspension of zinc oxide before the setts were planted, the tubers being cut, treated, and planted on the same day. Emergence followed promptly and reached 98 per cent. At late flowering, when large tubers had formed, the seed pieces were still sound.

ODEHNAL (J.). **Die Feststellung der in ihrer Vitalität abgeschwächten Knollen bei Kartoffelsaatgut mit Hilfe der Luminescenz im ultravioletten Lichte.** [The identification of seed Potato tubers with impaired vitality by means of luminescence in ultra-violet light.]—*Ann. Acad. tchéchosl. Agric.*, xvi, pp. 218–224, 1941. [Abs. in *Chem. Zbl.*, cxiii (i), 2, p. 279, 1942.]

The presence of certain types of disease or other defects resulting in the impaired vitality of potato tubers may be rapidly and reliably ascertained by exposure to the 'Tatra' quartz lamp. Under the influence of the ultra-violet rays tubers infected by *Rhizoctonia* [*Corticium*] *solani*, for instance, develop a blue fluorescence, which is likewise characteristic of those injured by freezing or softened by wilting in warm districts. Normal healthy tubers respond to illumination by a dark grey-green or yolk of egg-coloured fluorescence; those of the summer harvest in low-lying, unfavourable situations turn pale yellow on exposure to the rays, while the autumn crop in the same districts shows the blue coloration associated with defective material. Boiling does not destroy the fluorescence, but it disappears under formalin treatment.

EXNER (BEATRICE) & CHILTON (S. J. P.). **Cultural differences among single basidiospore isolates of Rhizoctonia solani.**—*Phytopathology*, xxxiii, 2, pp. 171–174, 1 fig., 1943.

Further details are given of the variations in potato dextrose agar cultures at 28° C. between ten single-basidiospore isolates of *Rhizoctonia* [*Corticium*] *solani*, four from Lima bean [*Phaseolus lunatus*], two from alligator weed (*Alternanthera phylloxeroides*), and four from potato, a preliminary note on which has already appeared [*R.A.M.*, xxii, p. 223]. For example, the growth rate from the 24th to 48th hour of 21 cultures of the fungus from a basidial mat on *P. lunatus* ranged from 26·3 to 37·2 mm., and comparable differences were observed among the isolates from the other hosts.

SCHAAL (L. A.) & EDMUNDSON (W. C.). **Late blight of Potatoes in Colorado.**—*Amer. Potato J.*, xx, 4, pp. 86–88, 1943.

The occurrence of potato late blight (*Phytophthora infestans*) for the first time in Colorado in 1941 has already been recorded [*R.A.M.*, xxi, p. 500]. The disease was also observed by the present writers near Gilcrest in July of the same year, and again in 1942, infection being mild in both seasons and unaccompanied by tuber rot, which was, however, observed in a severe form in the northern part of

the State, in some cases with little or no corresponding vine infection. Generally speaking, the rot was most prevalent on tubers lowest in the 'hill' and in those nearest to the irrigation trench, denoting that the conidia were disseminated by the irrigation water rather than conveyed to the surface of the tubers by rain.

The hot, dry days and cool, dry nights characteristic of Colorado summers are not conducive to the development of *P. infestans*, the outbreak of which in 1942 is attributed to the exceptional occurrence in an otherwise normal season of protracted periods of fog on eight days in August, which afforded ideal conditions for infection [ibid., xviii, p. 815]. Moreover, a heavy snowfall during the preceding winter (one of the coldest on record) prevented the freezing of the soil and permitted the growth of numerous 'volunteer' potato plants in the spring, some of which may have provided the initial inoculum for the epidemic of 1942.

The harvesting and storage of the diseased tubers in northern Colorado constituted a serious problem. The rot is difficult to detect on the red Bliss Triumph tubers, of which part of the crop consisted, so that diseased material was inadvertently stored instead of being discarded in the field. Cool storage was impracticable owing to the high prevailing temperatures during the first few weeks, and soft-rot organisms invaded the blighted tubers, causing a rapid breakdown in many cellars. Most of the severely rotted lots were sorted before 1st December, with a resultant loss of some 15 per cent. of the commercial crop.

NEWMAN (A. S.) & NORMAN (A. G.). **The activity of subsurface soil populations.**—*Soil Sci.*, lv, 5, pp. 377–391, 1 graph, 1943.

Sub-surface soil samples (Marshall, Fayette, Marion, Clarion, and Clinton silt loams and Shelby and Lindley loams) were investigated at the Iowa Agricultural Experiment Station and found to contain smaller, less versatile, and less adaptable microbiological populations than those occupying the superficial strata. Introduced plant material is less rapidly and extensively decomposed, presumably owing to the presence in the lower layers of antibiotic or inhibitory substances of microbial origin. The alcohol extract from surface soil samples (3 gm.) of Clarion silt loam significantly decreased the growth of *Penicillium humicola*, *Aspergillus sydowi*, *Zygorrhynchus vuillemini*, *Sporotrichum pruinosum*, and *Monilia humicola* in pure cultures on Waksman's fungal medium, a similar effect being exerted on all except *Z. vuillemini* by the extract from 1 gm. of the same soil. The same organism was definitely stimulated by the alcohol extract from 3 gm. of Marshall silt loam, which adversely affected the development of all the other moulds included in the tests.

Report on Forest Administration in the Mysore State for the year 1940–41.—244 pp., Bangalore, Govt Press, 1942.

The following reference of phytopathological interest occurs in this report (p. 11). Sandal [*Santalum album*] spike continued to be prevalent in parts of the Bangalore, Tumkur, Hassan, and Mysore districts, and a new centre of infection was observed in the Nandi Hills. The first few trees affected by the disease were detected in August in an area cleared and burnt for the establishment of plantations, and within a few months extensive spread had taken place from west to east, in the direction of the wind. Control measures, in the form of girdling and treatment with Atlas tree-killer [*R.A.M.*, xvi, p. 710] of all trees within the infected zone, were promptly undertaken.

JENKINS (ANNA E.). **Gloeosporium pestiferum, a synonym of Elsinoe ampelina.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 50–52, 1 pl., 1943.

On the basis of an examination of the original specimen of *Gloeosporium pestiferum* (F. M. Bailey 881) from the Herbarium of the Government Botanist,

Brisbane, Queensland, and from a review of the pertinent literature, the author concludes that the fungus is in fact *Elsinoe ampelina.*

Rogers (D. P.). **The genus Pellicularia (Thelephoraceae).**—*Farlowia*, i, 1, pp. 95–118, 118 figs., 1943.

This is a critical discussion of the genus *Pellicularia* Cke, synonyms of which are *Corticium* section *Botryodea* Bourd. & Galz. 1911, *Tomentella* section *Tomentellastrum* subsection *Botrytes* Bourd. & Galz. 1924, *Botryobasidium* Donk 1931, and *Botryohypochnus* Donk 1931. In addition to the type species, *P.* (*C.*) *koleroga* (*C. stevensii*), 15 are described, of which four are new and six are new combinations; *C. album* Dastur [*R.A.M.*, xix, p. 529] probably belongs to *Pellicularia.*

P. koleroga, an occupant of the under side of orange, coffee, persimmon, *Pittosporum*, and pear leaves, is characterized by obpiriform, short barrel-shaped, rarely short clavate basidia, 11·5 to 15 or 19·5 by 8·5 to 10 μ, bearing four horn-like sterigmata, 6 to 8 by 2 to 3 μ, and subcylindrical to elongate-subellipsoid, laterally apiculate spores, 10·5 to 16 by 3 to 5·5 or 7 μ. Although there is considerable variation in the shape of the spores, which in the Puerto Rican collection on coffee, for instance, are slender, subfusiform, and slightly curved, the differences are not considered to afford an adequate basis for specific separation, and Wolf and Bach are followed in their combination of *C. stevensii* with *C. koleroga* [ibid., vii, p. 247].

Synonyms of *P. filamentosa* (Pat.) comb. nov. are *Hypochnus filamentosus* Pat. 1891, *H. solani* Prill. & Del. 1891 [ibid., iv, p. 184], *C. vagum* var. *solani* Burt *ex* Rolfs 1903, *C. solani* (*Prill. & Del.*) Bourd. & Galz. 1911, *C. vagum sensu* Burt 1918 p.p., *C. vagum* subsp. *solani* (Prill. & Del.) Bourd. & Galz. 1928, *Botryobasidium solani* (Prill. & Del.) Donk, *C. areolatum* Stahel 1940 [ibid., xix, p. 341] nec *C. areolatum* Bres 1925, *Oidium citri* Bondar 1929 (*nomen nudum*), and *C. microsclerotia* Weber 1939 (*nomen nudum*) [ibid., xix, p. 3]. The fungus, which occurs on the living foliage or stems of *Boerhaavia erecta, Chimaphila maculata, Citrus* spp., carnation, fig, *Hydrophyllum virginicum*, tobacco, *Solanum dulcamara*, and potato, is characterized by subcylindrical, barrel-shaped, or obpiriform, clavate basidia, formed on the subbasidial hyphae in small, imperfectly symmetrical cymes, 10 or 12 to 18 or 23 by 8 to 11 or 12·5 μ, bearing four horn-shaped sterigmata, 3 or 5·5 to 12 or 20 by 1·5 to 3·5 or 4·5 μ, and ellipsoid or oblong-ellipsoid, truncate to apiculate spores, 7 to 12·5 by 4 to 7 μ, occasionally germinating by means of a stout promycelium carrying a similar secondary spore. It is distinguishable from the saprobic species by the flattened-ellipsoid spores with a peculiar truncate, almost jagged apiculus, by the four, usually long and thick sterigmata, and by the small and usually imperfect cymes of basidia. Though differentiable on morphology alone, the substratum, namely, parts of living plants or occasionally soil in contact with them, is the easiest diagnostic character.

The diseases associated with the various fungus names listed in synonymy seem distinct enough but the fungi show relatively slight variation. *C. areolatum* has the smallest spores (7·5 to 9 by 4·5 to 5 μ) whilst the type of *H. filamentosus* lies near the upper end of the spore range. The sclerotial stage of *P. filamentosa* has been described as *Rhizoctonia solani* and *R. microsclerotia*; Weber's name, *Corticium microsclerotia,* for the perfect state of the latter is regarded as a *nomen nudum.* It is possible that on different hosts and under varying circumstances a single pathogen may give rise to different pathological phenomena, but it would appear desirable to admit taxonomic segregation within the pathogen only when significant differences have been shown to exist between the fungi themselves; so far such differences have not been revealed.

The taxonomic classification of *P. vaga* (Berk. & Curt.) Rogers ex Linder 1942, prevalent in North America on the wood and bark of hard and soft woods, is complicated both by the variability of the fungus itself and the confusion introduced

by its identification by various authors with *P. filamentosa*. There is no important variation in gross appearance, in hyphae, or, except for dimensions, in basidia but the spores of *P. vaga* are navicular, 7·5 to 12 or 17 by 2·5 or 3·5 to 5 or 5·5 μ.

Four species included by Bourdot and Galzin in the section *Botryodea* of *Corticium* are excluded from *Pellicularia*. A key to the species of the latter genus is given.

SEELER (E. V.). **Several fungicolous fungi.**—*Farlowia*, i, 1, pp. 119–133, 2 pl., 1943.

This is a critical discussion, amplified by geographical and bibliographical annotations, of three genera of fungal hyperparasites, namely, *Eleutheromyces* Fckl emend. Seeler, *Micropyxis* Seeler n.g., and *Sphaeronemella* Karst. emend. Seeler, represented by one species each, viz., *E. subulatus* on agarics and polypores, *M. geoglossi* (Ell. & Ev.) Seeler n. comb., and *S. helvellae*. *Eleutheromycella mycophila*, growing on *Polystictus versicolor*, closely resembles *Eleutheromyces subulatus*.

DRECHSLER (C.). **Two species of Pythium occurring in southern States.**—*Phytopathology*, xxxiii, 4, pp. 261–299, 16 figs., 1943.

Detailed notes are given on *Pythium myriotylum*, a parasite of economic plants in certain southern States, and *P. ostracodes* n.sp., isolated from wheat roots in Texas, is fully described.

P. myriotylum is subject to attack by *P. acanthicum*, *P. periplocum*, and *P. oligandrum* [*R.A.M.*, x, p. 211; xviii, p. 650; xxii, p. 216], though in a less destructive form than the well-known pathogens, *P. ultimum*, *P. de Baryanum*, and *P. irregulare*. The three echinulate parasites emit numerous branches that invest the hyphae of *P. myriotylum*, in some places merely inducing noticeable abnormality, in others causing local disintegration of the protoplasmic contents, and elsewhere again intruding assimilative elements into the interior of the host. The hyphae of *P. ostracodes* are often more elaborately enveloped by the parasitic species than *P. myriotylum*, but without sustaining noteworthy damage. Moreover, the hyphae of *P. myriotylum*, *P. ostracodes*, and many other *P.* spp., are liable to complicated envelopment by such root-rotting members of the Saprolegniaceae as *Plectospira myriandra* [ibid., vi, p. 517] and the three strains of *Aphanomyces cladogamus* isolated, respectively, from diseased pansy, spinach, and flax [ibid., viii, p. 606]. In these cases, however, the relationship between the attacking fungi and their hosts appears to be antagonistic rather than actively parasitic.

MIDDLETON (J. T.). **The taxonomy, host range and geographic distribution of the genus Pythium.**—*Mem. Torrey bot. Cl.*, xx, 1, pp. 1–171, 17 figs., 1943.

The investigations fully described in this monograph—the most detailed and complete hitherto published on the genus *Pythium*—are based on a collection of over 2,000 cultures from various parts of the world, representing most of the known species.

The smooth or echinulate character of the oogonial wall are specific criteria, which have been utilized for purposes of classification, but the ranges and means of 200 oogonia of each species measured were so closely similar, in fact often identical, as to be quite devoid of taxonomic value. Other specific features are the origin and morphology of the antheridium, the plerotic or aplerotic condition of the oospore and the thickness and type of its wall, and temperature-growth relations.

The abandonment of the subgenera *Aphragmium* and *Nematosporangium* and the sections *Orthosporangium* and *Metasporangium* is advocated, and the general discontinuance of the use of subgenera and sections in the genus *Pythium sensu* Pringsheim proposed. The presence or absence of a septum delimiting a sporangium is too variable a character to be of taxonomic validity, and the mode of

sporangial germination is largely determined by the conditions of the immediate environment, zoospore production almost invariably occurring when the organs are placed in fresh running water and germ-tubes being exclusively formed on agar cultures without additional moisture.

The mode of zoospore formation has served as the principal differential character for the separation of *Pythium* and *Phytophthora*, and may, with certain reservations, be retained for this purpose. Under appropriate environmental conditions, the sporangia of *Pythium* give rise to an emission tube capped by a vesicle into which the homogeneous contents of the sporangium pass, to be differentiated through a series of cleavages into zoospores, the latter being liberated by the rupture of the vesicle. In *Phytophthora* the zoospores are produced within the sporangium and released either through the disruption of its wall or the dissolution of the papilla, no vesicle being normally present. The amphigynous type of antheridium predominant in the genus *Phytophthora* is unique, and has not been observed in *Pythium*. The growth habits of the two genera, moreover, differ sufficiently for their separation to be effected on a general macroscopic basis. To sum up, although there is no single infallible standard for the generic segregation of *Pythium* and *Phytophthora*, a number of attributes exist to simplify their differentiation in practice. The generic principles followed in this study are those established by Butler (*Mem. Dep. Agric. India*, Bot. Ser., i, 5, 1907) and Miss Matthews (Studies on the genus *Pythium*, 1931), involving the retention of *Pythium* in its original broad sense.

The present treatise comprises a critical discussion of 66 species recognized by the author as valid, supplemented by remarks on 29 referred to the doubtful or invalid category, a key to the species, a glossary, a 25-page bibliography, and an index. Mention should also be made of the original figures.

Davis (J. J.). **Parasitic fungi of Wisconsin.**—ii+157 pp., [printed privately], Madison, Wisconsin, 1942.

This list of parasitic fungi of Wisconsin, arranged in systematic order with host and parasite indexes, constitutes a record of collections in the Herbarium of the University of Wisconsin, which includes the herbarium of the late J. J. Davis. The list also includes a compilation of reports by W. Trelease and the author, published in the *Trans. Wis. Acad. Sci. Arts Lett.* from 1885 to 1937.

Petch (T.). **British Nectrioideae and allied genera.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 53–70, 1943.

This annotated list of British Nectrioideae, Patelloideae, and Stromaceae contains the following records of interest: *Polystigmina rubra* on leaves of *Prunus spinosa*, *P. insititia*, and plum; *Micropera spuria* on *P. spinosa* and plum; *M. padina* on cherry; *M. turgida* on ash; and, in the addenda, *Zythia fragariae* on pale yellowish-brown blotches with a narrow, dark purple border on leaves of strawberry.

Rawlins (T. E.). **Recent evidence regarding the nature of viruses.**—*Science*, N.S., xcvi, 2497, pp. 425–426, 2 graphs, 1942.

The author disagrees with Frampton's conclusion that tobacco mosaic virus particles may be composed of units 37 mμ long, joined end to end [*R.A.M.*, xxi, p. 307]. Measurements of the length of the tobacco mosaic particles in figures published by Anderson and Stanley [ibid., xx, p. 428] were made and the results subjected to statistical analysis. Both visual inspection and statistical treatment of the frequency curve of these length measurements indicate that there is small evidence of the larger particles being composed of shorter visible uniform units joined end to end. The lengths of the particles of the rib-grass [*Plantago lanceolata*] strain of tobacco mosaic virus were measured on the electron micrograph shown in fig. 2

of Holmes's paper [ibid., xxi, p. 227], a frequency curve of the lengths then being made. If the virus particles are molecules and the commonest length is the most probable value for the molecular length, in each virus there are many particles too long or too short for the difference to be due to errors in measurement and the longer particles do not consist of two or more molecules of the commonest length joined end to end.

That virus particles of a given rod-shaped virus have various lengths and that the longer lengths do not appear to be multiples of the most characteristic length would suggest that they are not molecules. In their variable length they resemble rod-shaped bacteria, while particles of a spherical virus, like most spherical bacteria, appear to have a relatively uniform diameter.

BERKELEY (G. H.) & PHILLIPS (J. H. H.). **Tobacco streak.**—*Canad. J. Res.*, Sect. C, xxi, 6, pp. 181–190, 2 pl., 1943.

Tobacco streak [*R.A.M.*, xxi, p. 516] was found for the first time in Ontario in 1937 and in Quebec in 1938, but there is reason to believe that it had been present in both provinces for some years. The percentage of infection in fields in both Ontario and Quebec is usually very low, but in two instances in the Blenheim-Ridgetown area 40 and 60 per cent., respectively, were encountered.

In greenhouse experiments in Ontario the virus causing streak was successfully transmitted by patch-grafting and juice transfers from tobacco to tobacco and to 11 other species of plants, namely tomato (by patch-grafting only), *Nicotiana glutinosa*, *N. rustica*, *N. sylvestris*, *N. langsdorffii*, *N. bigelowii*, *Nicandra physaloides*, *Datura stramonium*, *Antirrhinum majus*, *Calendula officinalis*, and *Phaseolus vulgaris* var. *humilis*. The incubation period of the virus was found to vary both with environment and with host, ranging on the average from 6 to 14 days after patch-grafting and from 4 to 10 days after juice transfer.

The primary symptoms produced on tobacco plants consisted of necrotic local lesions surrounded by concentric water-soaked lines or rings, which later became brown and necrotic. The necrotic lesions showed a tendency to spread along the veins, parallel necrotic lines appearing in the surrounding tissue, and sometimes to cause the collapse of the midrib and petiole. When numerous lesions and ring spots were present, the leaf turned yellow and died. The systemic symptoms appeared as a net pattern or sometimes as rings or partial rings with necrosis, at first brown but later greyish-white, closely associated with the veins and the bases of young leaves, although sometimes the bases of older leaves also showed typical necrotic lines, rings, or spots. The necrotic tissue often separated from and dropped out of the leaf; affected leaves were smaller than normal ones, and were narrow and slightly crinkled. Leaves may be affected on one side only, the midrib curling towards the affected side. No distinct mottle was observed, but a slight paling of the interveinal tissue may give a suggestion of mottling. On Turkish tobacco the recovered leaves may be coarsely toothed and a mild necrosis occasionally developed on the sucker growth; on the Burley varieties necrosis was more extensive and severe than on flue-cured varieties tested, the young leaves often dying before being fully developed. In thefield, and on older plants in the greenhouse, necrotic streaking of the stem, consisting of dark, almost black, shiny, sunken lines, was commonly observed, especially on Burley varieties. Frequently the woody tissue under the discoloured area, and even the pith, was also brown; conversely the pith and woody tissue may be discoloured with no visible external symptoms. Often, particularly in Burley varieties, the necrotic streaking may extend to the growing point, causing the top of the stem to turn at a sharp angle to form a 'crooked top'. On tomato, necrosis varied in intensity from a few scattered areas to a severe type of scorch the most conspicuous symptoms being the large, black, sunken spots or rings commonly developing on the fruits and extending deep into the tissues. The

seed from such fruits had greatly reduced germinability, but plants grown from it were healthy.

The virus was killed in extracted juice at 53° C. for 10 minutes and in patch sticks at 55° for 5, but was still viable in patch sticks after 15 minutes at 50°. The virus ceased to be viable in extract after 24 hours or less at room temperature. In experimental plots planted in 1939 and 1940, no mechanical spread of the disease was observed. The virus did not appear to overwinter in soil under Ontario conditions.

The virus was successfully transmitted from sweet clover [*Melilotus* sp.] to tobacco, and a disease resembling streak was induced in sweet clover by the transfer of the virus from tobacco. It is not known whether the disease in sweet clover was caused by one virus or a mixture of viruses, as the authors were unable to transmit any one source of tobacco streak from tobacco to sweet clover and back again or vice versa. Nevertheless, the experimental results obtained, supported by circumstantial evidence available, are taken to indicate that sweet clover is a host of the virus. All the evidence is stated to suggest that streak is spread to tobacco by insects from neighbouring weeds and possibly sweet clover, and control measures should, therefore, aim at the destruction of weeds in close proximity to tobacco, and the location of tobacco fields as far removed from sweet clover as possible.

SPENCER (E. L.) & PRICE (W. C.). **Accuracy of the local-lesion method for measuring virus activity. I. Tobacco-mosaic virus.**—*Amer. J. Bot.*, xxx, 4, pp. 280–290, 1943.

To test the accuracy of the local-lesion method (developed by Holmes in 1929 [*R.A.M.*, viii, p. 532]) for the estimation of the activity of an 'unknown' virus solution in terms of a standard preparation of the same virus, the authors conducted a series of experiments using the Early Golden Cluster bean as a test plant, and clarified juice of Turkish tobacco plants affected with mosaic as the virus solution. It was postulated from the outset that in determining the relative concentration of two virus samples it is necessary to measure not only the numbers of lesions produced by either, but also the rate at which the number of lesions decrease when the samples are diluted, that is, the slope of the dilution curve. The best results were obtained by comparing two dilutions of each of the standard preparation and the unknown solution on opposite halves of paired leaves of the same individual plants, choosing dilutions in such a way that the most concentrated of the two produced from 15 to 35 lesions per half leaf. Greater accuracy resulted from adjusting the concentrations of the standard preparation as closely as possible to those of the unknown solution; for that purpose, the approximate concentration of the latter was determined prior to the actual experiment. By using the experimental procedure outlined above it was possible to determine the activity of the unknown solution of virus with an error not exceeding 10 per cent. Limited tests indicated that using three dilutions of each sample instead of two gave sometimes more and sometimes less accurate data, while with five instead of three less reliable results were obtained.

MCKINNEY (H. H.). **Studies on genotypes of Tobacco resistant to the common-mosaic virus.**—*Phytopathology*, xxxiii, 4, pp. 300–313, 1943.

Comparative studies were carried out at Arlington Farm, Virginia, on several tobacco genotypes to determine (*a*) the differences in the amounts of the common mosaic virus produced therein, and (*b*) the effects of plant age on virus synthesis and movement.

In 1937–8 a total of eight tobacco collections displayed no visible signs of infection, and three of these, T.I. 448A [*R.A.M.*, xxii, p. 81], T.I. 450, and T.I. 1110B,

yielded no virus in the upper leaves late in the season, whereas some plants of the remaining five, viz., Ambalema, T.I. 320, T.I. 384A, T.I. 470A, and T.I. 472A3 contained infective material in comparable leaves. T.I. 448A was the only selection to yield no virus from the foliar samples collected midway between the bases and tops at an advanced date. Of the resistant types Ambalema carried the largest quantity of virus in these leaves.

Most of the further experiments were conducted in the greenhouse with T.I. 448A, Ambalema, and the susceptible Wisconsin-Havana Seed. The results clearly showed that T.I. 448A is more resistant to mosaic than Ambalema and greatly reduces the reservoir of inoculum overseasoning in the residues of roots and leaves (both upper and lower) in the soil. The virus does not move about freely in the resistant plants, nor does it enter the very young leaves of their growing tips in detectable amounts, at any rate after the ten-leaf stage is passed; in T.I. 448A from a quarter to half the plant at maturity is virus-free. Virus synthesis in inoculated resistant plants tended to be less in the upper leaves of old than in the comparable ones of young plants, and the upper leaves of old plants were inclined to be more resistant than the active young ones, indicating an acquisition of increasing resistance to mosaic in the successive leaves.

Evidence obtained from a grafting test indicated that the virus travelled no further in T.I. 448A scions on infected Wisconsin-Havana Seed stocks than it did in plants of the former inoculated directly. It would thus appear that the channels of virus flow are in some way restricted in the resistant selection. From the standpoint of gross pathology T.I. 448A falls into the class of so-called symptomless carriers, and is immune from mosaic, but the closer studies required for a solution of the basic problems of resistance and immunity must be concerned with minor as well as major signs of disease in resistant and highly susceptible genotypes. Even the slight changes induced by the virus in the oxidase, catalase, peroxidase, and protein contents of T.I. 448A represent traces of infection, and, as already suggested in an earlier note [ibid., xxi, p. 168], it seems unlikely that any of the reputedly symptomless carriers of tobacco mosaic are altogether free from the disease.

Bawden (F. C.) & Pirie (N. W.). **A preliminary description of some of the viruses causing Tobacco necrosis.**—*Brit. J. exp. Path.*, xxiii, pp. 314–328, 1942.

The authors describe the purification and properties of six cultures of viruses causing tobacco necrosis. Two of the cultures were considered to be identical. Three shared antigens but were serologically unrelated to the others, thus supporting the earlier findings [*R.A.M.*, xx, p. 383] that tobacco necrosis can be caused by different viruses.

Elrod (R. P.) & Braun (A. C.). **Pseudomonas aeruginosa: its role as a plant pathogen.**—*J. Bact.*, xliv, 6, pp. 633–644, 1 pl., 1942.

Two isolates of *Phytomonas polycolor*, the agent of a tobacco leaf spot in the Philippines, were found to be indistinguishable, on the basis of pyocyanin formation, growth at 37° C., and animal pathogenicity, from *Pseudomonas aeruginosa* [*R.A.M.*, xxi, p. 167]. Agglutination, complement fixation, and agglutinin-adsorption tests showed the two plant strains to be serologically identical with at least one animal isolate and closely related to others, while the uniformity of the group was also indicated by a limited biochemical comparison.

Fifteen isolates of *P. aeruginosa* from a variety of sources proved to be capable of attacking tobacco, on which they induced lesions identical with those described for *Phytomonas polycolor*. Many of the strains were likewise pathogenic to onion, cucumber, potato, and lettuce, the symptoms on which were exactly comparable to those caused by *Bacterium marginale* [*Pseudomonas marginalis*], thereby con-

firming the view of Mehta and Miss Berridge as to the homogeneity of the last-named organism and *P. aeruginosa* [ibid., iv, p. 252].

The adaptability of *P. aeruginosa* to both plant tissues and warm-blooded animals is considered to place it in a unique position among bacteria.

Walsh (T.) & Clarke (E. J.). **A chlorosis of Tomatoes.**—*J. Dep. Agric. Éire*, xxxix, 2, pp. 316–325, 2 pl., 1942.

A distinct chlorosis of tomato foliage was observed in the greenhouse during 1938 and was since found to be fairly widespread in Eire. The disease, which affects all varieties alike, is characterized by a partial or complete yellowing of most leaves, except the few top ones; only the midrib and its subsidiary veins and the petiole remain green, while the margins of leaves may retain their green colour for some time longer than the rest of the leaf, but turn yellow eventually. The affected leaves are crisp and brittle, and crackle and break when rolled. Severely affected leaves very often show a bronzed hue at the end of the season. The disease impairs plant vigour in the later stages of growth, reduces the yield and the size of fruit, and delays ripening. Severely chlorotic plants are especially susceptible to attacks by parasitic fungi. The disease was found to be invariably associated with an excessively high content of potassium in the soil and the consequent 'luxury consumption' of this element, but was not influenced by the hydrogen-ion concentration. Foliar analyses both of a quantitative and semi-quantitative nature showed in every case a greater concentration of potassium in diseased than in healthy plants (in some cases one-and-a-half times as great). The results of manuring trials demonstrated that the rate of uptake of potassium was directly proportional to the amount present in the medium, while the uptake of other elements was considerably depressed by the presence of higher concentrations of potassium. It is tentatively suggested that chlorosis might arise from the insufficient uptake of some vital element induced by the presence of excessive potassium. Studies aimed at a more fundamental explanation of the cause of chlorosis are stated to be in progress.

Small (T.). **Stem rot on outdoor Tomatoes.**—*J. Minist. Agric.*, l, 2, pp. 64–67, 1943.

During 1942 tomato stem rot (*Didymella lycopersici*), usually rare in England, was reported from several counties [*R.A.M.*, xxi, p. 542] following the extension of open-air tomato growing. The author gives an account of the disease based on his investigations in Jersey [ibid., xix, p. 500] and suggests control measures.

McKay (R.). **Tomato root rot Colletotrichum atramentarium (Berk. & Br.) Taubenh.**—*J. Dep. Agric. Éire*, xxxix, 2, pp. 272–276, 6 figs., 1942.

Root rot caused by *Colletotrichum atramentarium* is stated to be one of the most prevalent and injurious diseases of greenhouse tomatoes in Eire. Complete control of the disease can be attained by removing the top 15 to 18 in. of soil from the greenhouse bed and replacing them by fresh loam brought in from the pasture, or by sterilizing the soil with either formaldehyde (2 per cent. solution, applied at the rate of 50 gals. to every 10 to 18 sq. yds. of soil, the soil then being dug over and covered with tarpaulins for 48 hours) or steam.

Hirt (R. R.). **The relation of certain meteorological factors to the infection of Eastern White Pine by the blister-rust fungus.**—*Bull. N.Y. Coll. For.*, xv, 1a, 65 pp., 2 figs., 32 graphs, 1942.

This is a fully detailed account of the writer's studies, extending over a ten-year period in northern and central New York State, on the relation of temperature, relative humidity, rain, fog, dew, and sunshine to the natural and artificial infection

of eastern white pine (*Pinus strobus*) by blister rust (*Cronartium ribicola*) [*R.A.M.*, xvi, p. 427].

Black currant (*Ribes nigrum*) was used exclusively as a source of sporidia on account of its pronounced susceptibility to the rust. Teleutospores were produced in distinct crops once or repeatedly during each season of the investigations, the phenomenon being apparently associated with leaf maturity and condition and seasonal changes. The most effective response on the part of the teleutospores to weather favouring sporidial formation, and consequently pine infection, was observed when the crops were 96 to 216 hours old. Hence severe attacks of the rust were limited to comparatively few periods when appropriate weather conditions happened to coincide with the correct phase of teleutospore development on black currants. During the period covered by the tests, most of the outbreaks occurred in the latter half of August, a few early in September, and one in July.

The teleutospores attained maturity in 24 hours. The minimum time required for pine infection under optimum moisture and temperature conditions was 11·5 hours, the maximum incidence being recorded after 19·5. Most of the infection took place at night, when free moisture was present in the form of dew, fog, or rain, and the temperature commonly fell within the optimum of 50° to 65° F. A certain amount of rust did develop even above 70°, but only if the temperature was fluctuating between the upper and lower levels, a constant temperature of 68° to 69° sufficing to inhibit infection even where other factors were propitious.

The respective order of importance of rain, fog, and dew to pine infection and sporidial production was 10 : 2 : 1 and 10 : 7 : 2, respectively. It is apparent that the regular occurrence of night fogs throughout a summer season will not only induce nearly as copious sporidial production as rain, but will also, over a protracted period, intensify infection up to the point of severe damage. The character of the 12-hour periods immediately preceding and following rainfall exerted a definite effect on the incidence of *C. ribicola*. For instance, days of sunshine and high temperature prior to a night of rain tended to delay sporidial production to such an extent that there was not enough time for pine infection, especially if another warm, sunny day ensued. Less delay in the production of inoculum followed a cloudy and relatively cool day, some infection usually resulting after an ensuing rainy night. Every summer during the experimental years the bulk of infection occurred in one or two relatively brief periods of cool, wet weather corresponding with an abundant supply of freshly produced teleutospores, so that seasonal weather conditions alone are not normally a reliable index of the amount of rust.

Some degree of silvicultural control of blister rust may be exercised by the avoidance for *P. strobus* of planting sites in climatic zones where cool, damp nights are the rule or where extended rainy periods are apt to occur during the average summer. In such places specially frequent eradication of native *Ribes* may be required, with wider protective borders to provide a maximum degree of protection from the pathogen.

Union of South Africa Department of Agriculture and Forestry. Division of Forestry Annual Report for the year ended 31st March, 1941.—18 pp., 1941.

This report (pp. 9–10, 14) contains the following items of phytopathological interest. Pines in the Jessievale (Transvaal) plantation were extensively damaged by *Diplodia pinea* following a severe hailstorm, a total of 164 acres of *Pinus patula* and 64 of *P. pinaster*, equivalent to 550,000 cu. ft. of timber, being devastated by the fungus [*R.A.M.*, xx, p. 150]. *Oidium* spp. [including *O. quercinum*] were responsible for heavy mortality among enfeebled, old, ornamental oaks at the Cape: *Quercus palustris*, *Q. suber*, *Q. serrata*, and *Q. ilex* appear to be immune from the mildew. Sporadic outbreaks of 'Albert Falls disease' [ibid., xx, p. 326] were again observed in all wattle [*Acacia mollissima* and *A. decurrens*] -growing districts,

while collar rot [? *Rhizoctonia*: loc. cit.] was also prevalent, especially at Wartburg, where it was an important factor in weakening the roots of the trees and so predisposing them to destruction by a hurricane in May.

DARLEY (E. F.) & CHRISTENSEN (C. M.). **An unusual sporophore of Trametes suaveolens produced on artificially inoculated wood.**—*Phytopathology*, xxxiii, 4, pp. 328–330, 1 fig., 1943.

In a preliminary study at the Minnesota Agricultural Experiment Station to determine the influence of environment on the gross morphology of fruit bodies, involving a comparison of sporophores observed in nature and produced artificially, a hole 1¼ in. in diameter and 6 in. deep was bored in sections 7 in. long and 2½ in. in diameter of green ash (*Fraxinus pennsylvanica* var. *lanceolata*) and soft maple (*Acer saccharinum*), and filled to within 1 in. of the top with a mixture of wheat and oats that had been autoclaved at 15 lb. pressure for one hour on two consecutive days. The holes were loosely corked and the two pieces of wood placed vertically in a gallon jar containing about 500 c.c. water, which was autoclaved for an hour at 15 lb. pressure and left to cool prior to the inoculation of the grain mixture with a culture of *Trametes suaveolens* from maple. The considerable differences in the general form of the resultant sporophores and in the size, shape, and position of the pores, as compared with the original fruit body, are tentatively attributed to the more or less diffused light to which the cultures were exposed, a somewhat similar phenomenon having been observed in *Daedalea confragosa* under comparable conditions (*Mycologia*, xxxiv, pp. 400–402, 1942). Since small differences in environment can induce considerable changes in the growth morphology of sporophores, too much importance should not be attached to minor morphological differences between fruit bodies in nature.

CARRERA (C. J. M.). **Estudio sobre la fisiologia de la Phytophthora capsici Leonian productora del 'mildiu o tizón' del Pimento en la Argentina.** [A study on the physiology of *Phytophthora capsici* Leonian, the agent of Chilli 'mildew or blight' in the Argentine.]—*Rev. Fac. Agron., B. Aires*, x, 1, pp. 156–193, 18 figs., 1942. [English and Portuguese summaries.]

A fully detailed, tabulated account is given of the author's studies on a number of physiological problems connected with chilli blight (*Phytophthora capsici*) in the Argentine [*R.A.M.*, xx, p. 224], the results of which may be summarized as follows. The fungus was shown by inoculation experiments to be pathogenic to tomato and eggplant in addition to its natural host. The organism grew best on the following liquid media (natural): 2 per cent. glucose potato broth, oatmeal broth, peptone, carrot broth, 1 per cent. glucose, and 2 per cent. peptonized broth, while the most suitable synthetic substrata were Leonian's, Mayer's, and Fermi's solutions. Rice agar was the best of the solid media tested, followed by oatmeal and 1 and 2 per cent. glucose agars. The average weight of the mycelium on a medium containing, besides dextrose and peptone (2 and 5 gm., respectively), 0·5 gm. each of potassium phosphate and magnesium sulphate and 0·2 gm. succinic acid per 1,000 c.c. distilled water, was 0·0445 gm., the corresponding figures for a substratum lacking peptone, potassium phosphate, magnesium sulphate, succinic acid, or dextrose being 0·0185, 0·028, 0·026, 0·027, and 0·0115 gm., respectively. The substitution of citric for succinic acid resulted in a yield of 0·0385 gm. from a 0·5 per cent. concentration, whilst an inhibitory effect was exerted by tartaric and citric acids at concentrations of 1 to 3 and 2 to 3 per cent. respectively. The fungus proved to be extremely sensitive to sodium arsenite and agallol. *P. capsici* was found to be capable of growth over a wide range of hydrogen-ion concentrations (P_H 3·8 to 7·8), the optimum being 6·8. The minimum, optimum, and maximum temperatures for growth were under 8° to 8·5°, 30° to 31°, and above 37° C., respectively.

Baylis (G. T. S.), Deshpande (R. S.), & Storey (I. F.). **Effect of seed treatment on emergence of Peas.**—*Ann. appl. Biol.*, xxx, 1, pp. 19–26, 3 graphs, 1943.

A full account is given of studies made from 1937 to 1941 on the control of pre-emergence damping-off of garden peas (mainly *Pythium* spp.) obtained with various seed dressings, in relation to sowing date, soil type, pea variety, and dosage of fungicide.

A test of the effect of soil temperature and soil moisture on emergence was conducted in July, 1939, in frames, seed of the Pilot (round) and Gradus (wrinkled) varieties being sown in boxes in ordinary compost. These seeds were watered either immediately on sowing or at intervals of 1, 2, and 3 days afterwards. It was found that watering immediately after sowing markedly depressed emergence, progressive improvement resulting as the date of watering was deferred. There appears to be a critical period during germination when high soil moisture is extremely deleterious. The duration of this period depends upon the germination rate, which is related to soil temperature. Further experiments confirmed the fact that high soil moisture accentuates the pre-emergence damping-off of peas.

The chief results obtained from experiments in dressing seed with fungicides were that ceresan and cuprous oxide markedly increased emergence, and that this effect was greater with cuprous oxide than ceresan but the latter has the advantage of reducing the amount of seed-borne (*Ascochyta*) disease. The addition of a sticker was deleterious to both, more so to cuprous oxide than to ceresan. It was also found, in general, that emergence of untreated peas was better at the later than at the earlier sowing date, and that this effect was most marked in the heavy soil, that the relative improvement from seed treatment was greatest in the early sowing, and that the wrinkled varieties Gradus and Lincoln gave the best response to seed treatment. The greatest improvement was with the early sowing in heavy soil. No evidence was obtained of any beneficial effect from the incorporation of a growth hormone with the seed dressing, or that such hormone reduces liability to phytocidal injury.

Agricultural research.—*Rep. imp. Coun. agric. Res., Delhi, 1941–42*, pp. 3–39, 1943.

In this report [cf. *R.A.M.*, xxi, p. 342] it is stated that race 34 of cereal black rust [*Puccinia graminis*] and a new race, H, of yellow rust [*P. glumarum*] have been discovered in India. Malling type XIII apples remained resistant to *Rosellinia* [? *necatrix*]. Peach sun scald was reduced by tying straw to the trunks of trees.

Bemisia gossypiperda induces yellow vein mosaic of bhendi [*Hibiscus esculentus*: ibid., xx, p. 242; xxi, p. 342] with greatly increased rapidity if made to fast immediately before being fed on an affected plant. Fasting for over two hours seems to increase the efficiency of the vector. The shortest period for which white-flies, after being made to fast, should feed upon a diseased leaf in order to become infective is 30 minutes. Infective individuals can transmit the virus in feeding periods of 30 minutes, and sometimes in 15. The minimum incubation period in the vector was seven hours under the experimental conditions. Infective flies retain their infectiveness until their death. The virus cannot pass from the fly to its offspring through the egg.

Nicotiana glutinosa and *Petunia hybrida* were found to be infected by the *Datura* mosaic virus [ibid., xxi, p. 342]. The virus induced local lesions in the former, but only a transitory mottling in the latter.

Fifty-fifth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year 1941–42.—58 pp., 1942.

The following items of phytopathological interest, besides those already noticed from other sources, occur in this report [cf. *R.A.M.*, xx, p. 153]. Severe peach mosaic [ibid., xxii, p. 258] has been reduced from 28,934 trees in 1935 to 360 in 1941.

A minimum incubation period of 100 days was found to be necessary for the development of the disease. During the season 1,600 cross-inoculations were made by budding and grafting, the results of which demonstrated the existence of antagonism between the mild and medium strains of the virus on the one hand and the severe on the other. A distinct relationship has been observed between peach mosaic and wild morning glory areas, the latter plant being a summer and autumn host of the peach aphid [*Myzus persicae*]. Trees in such areas showed 33·1 per cent. foliar mosaic, compared with 17·2 and 3·2 per cent., respectively, in adjacent plots and isolated, respectively.

The aster leafhopper *Macrosteles divisus* (Uhl.) was found to convey yellows [ibid., xxii, 206] from aster [*Callistephus chinensis*] to lettuce and celery. A disease responsible for the destruction of celery crops in two localities in 1940 was not transmitted by *M. divisus* but by *Aphis heracella* (Davis), indicating either that the virus is a new one or that a new vector for aster yellows has been found. Plots enclosed within a cloth fence 3 ft. in height were completely protected from aster yellows, and this procedure is recommended for commercial and home gardeners during the critical months of July and August.

None of the 48 carnation varieties proved more than moderately resistant to root rot (*Fusarium dianthi*), but the introduction of chloropicrin into the soil destroyed the pathogen.

Plant pathology.—*Rep. Okla. agric. Exp. Sta., 1940–42,* pp. 63–65, 1 fig., 1942.

This report contains, *inter alia*, the following items of interest. Complete control of loose smuts of wheat and barley [*Ustilago tritici* and *U. nuda*] was obtained in two seasons' tests in 20 communities in which the Oklahoma type control equipment [*R.A.M.*, xx, p. 10] was used. Seed injury was reduced to 17 per cent., but it is believed that still greater reduction can be achieved.

Average yield increases of 19 per cent. were obtained in five years' trials with cotton seed treatment against disease [ibid., xxii, p. 205]. As a result of publicity given to this work, over 75 per cent. of the seed planted in the State in 1942 is stated to have been treated, as against 5 per cent. in 1939. The profit to farms resulting from the treatment is estimated for 1942 at more than $1,200,000.

JOHNSTON (C. O.). **Notes on plant diseases in Kansas in 1941.**—*Trans. Kans. Acad. Sci.*, xlv, pp. 107–110, 1942.

Detailed notes are given on the prevalence of a number of plant diseases affected by the exceptional weather conditions prevailing in Kansas during the spring and summer of 1941 [*R.A.M.*, xix, p. 203].

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. X. Mitteilung. Die Virulenzsteigerung von Pseudomonas tumefaciens durch Titan.** [Crown gall and its agent *Pseudomonas tumefaciens*. Note X. The enhancement of virulence in *Pseudomonas tumefaciens* by titanium.]—*Zbl. Bakt.*, Abt. 2, civ, 23–24, pp. 395–401, 2 figs., 1942.

The addition to cultures of *Pseudomonas* [*Bacterium*] *tumefaciens* on a synthetic medium of 0·0001 to 0·001 per cent. titanium sulphate resulted in a marked access of pathogenicity, judged by the size of the tumours induced on *Datura tatula* by the dahlia isolate (Ra) of the organism [*R.A.M.*, xxi, p. 444].

MELHUS (I. E.), SHEPHERD (D. R.), & CORKLE (MARIE A.). **Diseases of cereals and Flax in Iowa.**—*Proc. Iowa Acad. Sci.*, xlix, pp. 217–247, 1942.

This paper is described as 'an attempt to summarize available records of the prevalence and destructiveness of the diseases of cereals and flax in Iowa and to interpret the early general reports on the basis of our present knowledge of plant

pathology'. Among the points of special interest the following may be mentioned. Applying the hypothesis of N. E. Stevens, that Stewart's disease of maize (*Bacterium* [*Xanthomonas*] *stewarti*) will usually be absent following a winter with a temperature index below 90 and present in destructive amounts after one with an index above 100 [*R.A.M.*, xx, p. 528], to the seasons of 1931 and 1933, when the pathogen caused considerable losses in the State, the relevant indices were found to be 91 and 77, respectively. Several very desirable resistant strains have recently been developed and one of these, Ioana, has been distributed by the Agricultural Experiment Station.

The heaviest losses from crown rust of oats (*Puccinia coronata*) recorded in Iowa of recent years were 24 and 30 per cent. in 1938 and 1941, respectively. In such years the spores are believed to be blown into the State *en masse* from infection centres in the south. Plentiful moisture and moderate temperatures in May favour the development of the aecidial stage of the rust on *Rhamnus* spp., while similar conditions in June promote its rapid spread on oats. The epidemics of oats smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) of 1928, 1932, and 1941 were the heaviest of recent years, each involving a loss of 7 per cent. Low soil moisture in April tends to increase the liability of the host to infection. Root necrosis caused by *Pythium de Baryanum* has been engaging the attention of Iowa phytopathologists of late years. The losses from this disease reported for 1938, 1939, 1940, and 1941 were 12, 6, 12, and 7 per cent., respectively.

Stem rust of wheat (*Puccinia graminis*) has been conclusively proved to migrate from the southern States into Iowa, where serious losses from this source occur only in years when the wind-blown inoculum is plentiful, southerly winds prevail for several days during the growing season, local crops are later than usual, and environmental conditions favour the establishment and spread of the pathogen. The almost complete elimination of spring wheat from the Iowa cropping scheme is attributed largely to stem rust.

In 1935, 1936, and 1937 seed treatment of Redwing and Bison flax increased field stands by 68, 20·7, and 9·6 per cent., respectively, probably in large part by controlling the soil-borne organisms, *Pythium de Baryanum* and *Rhizoctonia* [*Corticium*] *solani*.

WARNER (J. D.). **New Oat varieties for the southeast. Florida's Quincy Nos. 1 and 2, highly resistant to rust and smut, also show promise in Georgia and Alabama.**—*Sth. Seedsm.*, v, 12, pp. 9, 29, 1942.

Quincy Nos. 1 and 2, two varieties of oats distributed in 1940, are both resistant to rust [*Puccinia coronata*], the former being immune from, and the latter highly resistant to, smut [*Ustilago avenae* and *U. kolleri*]. No. 1 (Victoria × Kanota) is a red variety and No. 2 (Red Rustproof × a hybrid between Victoria and Norton) white.

ELLETT (C. W.). **Leaf blight of Corn.**—*Phytopathology*, xxxiii, 5, pp. 407–408, 1943.

Two types of dent corn [maize] leaf blight have been experimentally shown to occur in Ohio, where losses from this source during the past four years are estimated to exceed those from any other disease, viz., bacterial (*Phytomonas* [*Xanthomonas*] *stewarti*) and fungal (*Helminthosporium turcicum*), the former causing serious losses in but few instances and the latter being the more prevalent and also affecting Sudan grass and *Sorghum halepense*. The symptoms of the two disorders are usually distinguishable without difficulty in the field. The bacterial lesions are irregular spots or streaks, often extending almost the entire length of the leaf, while those of the fungus are roughly elliptical, up to 14 by 1 to 4 cm., sometimes zonate, with a brown to reddish margin and a greenish-black growth of conidiophores and conidia often covering the centre. In both cases coalescence of the

lesions is frequent and the leaf soon dies and shrivels. Preliminary greenhouse tests of the reaction to *H. turcicum* of 24 inbred lines, 26 single, and 6 double crosses yielded no evidence of seedling resistance, but in the field there were marked differences in the amount of infection, among the more resistant inbred lines being KYS, Ia. L317, Ia. L289, Ohio 02, and Ohio 40B, and Hybrids Ia. 939, U.S. 13, and Ohio L86.

SEMENIUK (G.). **Charcoal-rot of Maize, new to Iowa.**—Abs. in *Proc. Iowa Acad. Sci.*, xlix, p. 256, 1942.

Charcoal rot of maize (*Sclerotium bataticola*) [? *Macrophomina phaseoli*] was observed, for the first time in Iowa in mid-August, 1941, on several prematurely dead stalks in an early-planted field. Greenhouse inoculation tests with the pathogen resulted in seedling infection with necrosis of the roots and mesocotyl.

TIMM (E.) & LINDSTROM (E. W.). **Experimental proof of mutation in virulence of the bacterial wilt pathogen of Maize.**—Abs. in *Genetics*, xxviii, 1, p. 94, 1943.

Beginning with a single cell of *Phytomonas* [*Xanthomonas*] *stewarti* of medium-plus virulence, 55 mutants were isolated and stabilized at the Iowa State College [*R.A.M.*, xxi, p. 523], and tested, together with six parental strains and three controls, for pathogenicity in a triple-lattice greenhouse experiment by means of individual plant inoculation of a highly susceptible line of sweet corn. The 55 mutants were found to exhibit highly significant differences in degree of virulence as measured by lesion and plant-weight indices, most of them emerging with a lower level of pathogenicity than that of the parents: three, however, were more virulent than their progenitors, two significantly so. The variants further differed in colony morphology, for which they bred as true as did the parent strain.

KUNG-HSIANG (L.). **Convex gum, a new disease of Citrus in China.**—*Phytopathology*, xxxiii, 5, pp. 394–396, 1 fig., 1943.

Orange trees, mostly young, in Fukien Province, China, were observed in 1941 to be suffering from a disease, believed to be caused by a seed-transmissible virus related to psorosis and characterized by two types of cortical swelling and gummosis of the trunk, limbs, and twigs. In the commoner and more serious form, the bark swellings are large (average 2·5 cm. in diameter on the trunk), smooth, and more or less round, and an abundance of brownish gum, of a semi-liquid to cheesy consistency, is produced in large, flattened pockets in the wood, 1 to 5 mm. below the cambial layer, and may rupture the cortex, on which canker-like, coalescent lesions are formed, later girdling and killing the twigs. The affected trees are liable to be killed or severely stunted. On the other hand, little damage is caused by the relatively small swellings (1 cm. in diameter) and dark brown, gum-filled spots of the less prevalent second type. The average incidence of the disease in several Foochow orchards was 64 per cent.

For the control of convex gum the author proposes a system of certification based on the Californian treatment of psorosis [*R.A.M.*, xviii, p. 248; xix, p. 86].

One 30-year-old tree (only two of this age were found to be diseased) recovered after the excision of the infected tissue and the application to the soil of liberal quantities of fertilizer.

ROBÁ (R. P.). **El 'ojo de gallo'; enfermedad del Cafeto.** [The 'cock's eye' disease of Coffee.]—*Bol. Minist. Agric. Nicaragua* 7, 15 pp., 5 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 6, p. 778, 1943.]

Coffee leaf and berry spot (*Omphalia flavida*), stated to be one of the most injurious diseases of the crop in Nicaragua, is described in relation to its geographical distribution, propagation, factors promoting its development, and control.

HARRISON (G. J.). **Breeding California Cotton.**—*Calif. Cultiv.*, lxviii, p. 696, 1941. [Abs. in *Plant Breed. Abstr.*, xiii, 3, p. 241, 1943.]

Tests of the reaction of the cotton varieties grown in California to *Verticillium* wilt [*V. albo-atrum*: *R.A.M.*, xix, p. 14; xx, p. 393] have been made both in the laboratory and the field, with comparable results in the two series. Resistance to the disease has been shown to be generally associated with late maturity, small bolls, and short staple, but certain American-Egyptian varieties were also found to be capable of withstanding infection. Direct selection, hybridization, and back-crossing are being successfully used in breeding for wilt resistance.

PRESLEY (J. T.) & KING (C. J.). **A description of the fungus causing Cotton rust, and a preliminary survey of its hosts.**—*Phytopathology*, xxxiii, 5, pp. 382–389, 2 figs., 1943.

The causal organism of cotton rust in Arizona and Texas, previously tentatively referred to *Puccinia boutelouae* [*R.A.M.*, xxi, p. 253], has been found by G. B. Cummins to differ from that and all species heretofore described on *Bouteloua* in the presence in its uredospores of three equatorial pores instead of several scattered ones, and it is accordingly designated *P. stakmanii* n. sp.

The fungus is characterized by amphigenous and caulicolous, punctiform, honey-yellow to cadmium-orange, later brownish, depressed, globose pycnidia, 90 to 120 μ in diameter, occurring in small, slightly raised, circular groups, with ostiolar filaments 60 to 100 μ long; cylindrical aecidia, 0·4 to 1 by 0·2 to 0·3 mm., surrounding the pycnidia in irregular groups; an orange, later yellowish or hyaline peridium, with a lacerate, recurved margin and quadratic or oblong cells, 17 to 30 by 11 to 20 μ, with a striate outer wall, 6 to 9 μ in thickness, and a strongly echinulate inner wall, 2·5 to 4 μ; globoid or broadly oblong aecidiospores, 18 to 25 by 13 to 19 μ, with very pale yellow to hyaline, finely verrucose walls, 2 to 5 μ thick; mostly epiphyllous, interveinal, oblong or linear, confluent, pale cinnamon-brown, pulverulent uredosori, 0·3 to several mm. in length; globoid to broadly ellipsoid uredospores, 25 to 27 by 18 to 22 μ, with a pale cinnamon-brown, moderately echinulate wall, 1·5 to 2·5 μ in thickness, with pores as mentioned above; amphigenous and caulicolous, rounded, elliptical or linear, confluent teleutosori, 0·3 to several mm. in length; and oblong or broadly ellipsoid teleutospores, 26 to 38 by 19 to 25 μ, with dark chestnut-brown walls, 4 to 9 μ thick at the apex, furnished with one septum, sometimes oblique or vertical, and a hyaline pedicel, two or three times the length of the spore. The pycnidial and aecidial stages are found in nature on the leaves and stems of *Gossypium barbadense* and *G. hirsutum*, and the uredo- and teleutosori on *B. rockrothii*. In greenhouse inoculation experiments all the cultivated cotton varieties represented in *G. barbadense*, *G. hirsutum*, and *G. hopi* were classed as susceptible; *G. arboreum* was mildly susceptible, eight out of ten wild cotton species were mildly susceptible and one susceptible; and five other Malvaceae resistant. Four out of five species of *Bouteloua* tested were susceptible and one mildly so, while eight species of *Muhlenbergia* and nine of *Sporobolus* were resistant.

In normal seasons the moderate amount of defoliation caused by *P. stakmanii* does not seriously impair the health of the plants, but the severe attacks coinciding with frequent rains and high relative humidity in the late summer or early autumn, such as occurred in Hidden Valley, Arizona, in 1940, may result in the shedding of most of the leaves and many of the bolls. Fields have been observed in which the incidence of infection reached 100 per cent. and more than half the effective leaf surface of the plants was destroyed or damaged. The alternate grass hosts of the rust in or on the borders of irrigated cotton plantations commonly grow much larger and produce more inoculum than the desert-grown specimens

dependent on rainfall; hence some degree of control may be achieved by clean cultural practices both within and along the borders of the fields.

CHESTER (K. S.) & RAY (W. W.). **How to get better Cotton yields in 1943 by seed treatment.**—*Circ. Okla. agric. Exp. Sta.* C-109, 8 pp., 3 figs., 1943.

In 1942 much of the cotton seed sown in Oklahoma was imported from other States and had been treated, with the result that the crop for that season was good, whereas the seed to be sown in 1943 is home-grown and must be treated. Five years' tests showed that seed disinfection (at a cost of only a few cents per acre) gave an average increase in yield of 19 per cent. Seed treatment is important because it prevents or delays infection by the most prevalent and serious cotton disease in Oklahoma, angular leaf spot [*Xanthomonas malvacearum*: *R.A.M.*, xxi, p. 414].

The most useful treatment under local conditions is that with new improved ceresan, but as this chemical is likely to be in short supply, 2 per cent. ceresan is recommended, though (if the seed is to be sown in neutral to alkaline soils) spergon may be used instead. Instead of the 1½ oz. of new improved ceresan per bush. of fuzzy seed usually applied, the amount may be reduced to 1 oz. or even to ½ oz. if the dust is well mixed with the seed. The dosage of 2 per cent. ceresan can be reduced from 3 to 2 or 1½ oz. per bush. if applied to re-ginned seed. With spergon the dosage may be 3 oz. per bush. of fuzzy seed, or 2 oz. per bush. of re-ginned seed. The seed should be stored in a fairly air-tight container for 24 to 48 hours after being treated. When treated cotton is used, the sowing rate may be reduced by one-third without impairing the stand. Thus, the cost of seed and chopping can be lowered, and seed conserved for war uses. In general, ½ bush. of treated seed gives as good a stand as ¾ bush. of untreated, if sown at a moderately even rate. Seed may be treated from one day to a year before sowing. Directions are given for making a metal drum seed treater and one of the box type.

DRECHSLER (C.). **A new nematode-capturing Dactylella and several related Hyphomycetes.**—*Mycologia*, xxxv, 3, pp. 339–362, 4 figs., 1943.

The author describes a further new predaceous fungus parasitic on nematodes [*R.A.M.*, xxii, p. 136] under the name of *Dactylella heterospora*, found in Virginia. Descriptions are also given of three new species, *D. heptameres*, *D. rhopalota*, and *D. atractoides*, all found in Maryland, which belong to the same group, but have not yet been proved to be either predators or parasites.

DRECHSLER (C.). **Two new Basidiomycetous fungi parasitic on nematodes.**—*J. Wash. Acad. Sci.*, xxxiii, 6, pp. 183–189, 2 figs., 1943.

Technical diagnoses are given of two additional fungous parasites of nematodes, viz., *Nematoctonus* [*R.A.M.*, xxi, p. 15] *pachysporus* n. sp., destroying a member of the *Rhabditis* group in decaying tomato roots near Beltsville, Maryland, and *N. leptosporus* n. sp., attacking a species of *Bunonema* [cf. ibid., xxii, p. 136] in leaf mould in the Fairfax district of Virginia.

MCCLELLAN (W. D.). **Control of powdery mildew of Roses in the greenhouse.**—*Bull. Cornell agric. Exp. Sta.* 785, 39 pp., 2 figs., 2 graphs, 1942.

A full account is given of an investigation carried out under laboratory and commercial greenhouse conditions in New York into the control of rose powdery mildew (*Sphaerotheca pannosa* var. *rosae*) [*R.A.M.*, xviii, p. 681]. The toxicity of 50 different fungicides to the conidia of the fungus on excised rose leaves was determined by spore germination tests, and the superiority of sulphur over copper fungicides clearly demonstrated. For the more critical comparison of fungicides, spore germination tests were carried out on parts of the same leaflet after treat-

ment with a known amount of a given fungicide applied by means of a spray tower. Conidia were dusted over all portions simultaneously and the results analysed statistically. The toxic action of ten different materials, including a particulate sulphur, soluble and insoluble coppers, and silver on the conidia on rose leaves was investigated. When the conidia were not wet with the fungicide, only sulphur reduced germination appreciably, while when they were wet for a short time, the soluble coppers as well as sulphur markedly reduced germination.

In tests in commercial greenhouses sulphur dust was ineffective for control purposes. Good control was, however, achieved with five wettable sulphurs, including walcolized sulphur (Walco Products, N.Y.), mike, fungisal, and protex colloidal sulphur (Protex Industries, N.Y.), and one copper material when used in a protective spray programme in combination with IN 438 (64 per cent. sodium oleyl sulphate: Du Pont) at a concentration of 1 in 1,000 as a wetting agent. The latter when used alone was more effective than sulphur dust, which was, moreover, the only material that caused foliar discoloration. The disease can be easily controlled by protective spraying, but once the infection becomes severe control is difficult. In tests of 21 miscellaneous materials as eradicant sprays, malachite green gave the best control, but caused some blossom discoloration. Excellent control, but severe foliar injury, resulted from spraying with four different soluble sulphurs. Good control without any burning was given by the particulate sulphurs. Excellent control followed the use of R.S. 380, a thiocyanate-containing insecticide (Röhm and Haas Co., Philadelphia) in an eradicant spray.

The relative effectiveness of wetting agents as spray supplements in mildew control was next studied. Evidence obtained demonstrated that surface tension and contact-angle measurements, used as criteria of wetting ability, do not invariably rate wetting agents in the same order. Leaf age, surface, and variety all affected contact-angle measurements. In all varieties the lower surface was, as a rule, the more difficult to wet. When rose leaves unfold they are not particularly difficult to wet, but become increasingly so up to the sixth day, after which wetting becomes gradually easier.

Conspicuous differences in toxicity, as measured by spore germination tests, were observed when 15 spray supplements were compared. Of those under test, IN 181 (72 per cent. sodium lauryl sulphate: Du Pont) was the most toxic. When the same supplements were compared in combination with the same particulate sulphur in each test in an eradicant-spray programme under commercial greenhouse conditions, marked differences in control resulted. Good control followed when vatsol [ibid., xix, p. 374] OT (sodium alkyl ester of sulphosuccinate: American Cyanamid and Chemical Corp.), IN 438, IN 181, and Grasselli spreader-sticker were used as the spray supplements. These differences were attributed to variations in wetting and in the toxicity of the supplements, and were not noted when the materials were used in a protective spray programme.

In preliminary tests only 6·8 per cent. of the lesions remained active after a three-day exposure to sulphur vaporized at 112° to 115° C., while 77·4 per cent. were active after similar exposure to sulphur vaporized at 85°.

The effect of syringing on the mildew was determined in a badly infected commercial greenhouse. Replicator plots syringed once, twice, three, and six times a week for four weeks showed 430·5, 312·75, 292·25, and 112·5 mildew lesions per plot, respectively. As, however, the treatment provides ideal conditions for the dissemination of *Diplocarpon rosae* and increases labour it is not recommended in practice.

BICKERTON (J. M.). **Fusarium wilt of Carnations caused by Fusarium dianthi Prill. et Del.**—*Bull. Cornell agric. Exp. Sta.* 788, 31 pp., 6 figs., 2 graphs, 1942.

Fusarium wilt of carnations, caused by *F. dianthi* [*R.A.M.*, xv, p. 225], was

observed for the first time in 1898 in Connecticut, and has subsequently been reported from France, South Africa, Uganda, Denmark, Italy, Czechoslovakia, England, Belgium, Germany, New Zealand, [and the Argentine: ibid., xx, p. 235]. In the United States a wilt caused by *F. dianthi* or *F.* sp. has been recorded from 15 widely scattered states, and has been identified by the author on material from Illinois.

Under the conditions on Long Island, where a study of the disease was carried out by the author from 1933 to 1940, losses caused by *Fusarium* wilt are stated to be second only to those due to *Alternaria* blight [*A. dianthi*: ibid., xvi, p. 659]. The disease generally kills the affected plants, and may cause a complete loss of certain varieties in the greenhouse as well as in the field. Losses from the disease in the field or in the greenhouse prior to the final benching are slight in comparison with subsequent losses. In the permanent location in the greenhouse most infections occur in autumn or spring, decreasing slightly during the winter. Field observations and inoculation experiments showed that among commercial varieties, My Love and Spectrum Supreme are extremely susceptible, while Puritan, Patrician, Peter Fisher, and Maine Sunshine appeared to be highly resistant. The symptoms of the disease are typically unilateral and comprise yellowing, wilting, stunting, and necrosis. They spread upwards following the gradual upward extension of the pathogen and the discoloration of the vascular tissue of roots and stem, until finally an entire plant is affected and eventually killed. The disease can be recognized by the clusters of sporodochia and pionnotes, the minute sclerotial bodies, and the white mycelium on the surface of diseased tissue. The main source of infection is infested soil, in which the pathogen was shown to survive for two winters, but infected cuttings and plants are also important.

Infection occurs principally through the roots but also through wounds in the base of the main stem. Inoculations at 70° to 80° F. resulted in 92 per cent. infection, at 60° to 70° in 66 per cent., and at 50° to 65° in 39 per cent. The latent period of infection for stem wound infections ranged from 12 to 28 days at 70° to 80° and up to 41 days at 50° to 65°, and that for root infections from 23 to 45 and 56 to 75 days, respectively. High temperatures, however, not only increased infection and shortened the incubation period but increased the rate of mortality.

In control experiments disinfection of bench soil in the greenhouse with concentrated commercial formalin (1 gal. per 50 sq. ft.), and particularly chloropicrin (by injection at the rate of 2, 2½, and 3 c.c. per sq. ft.) resulted in a marked reduction in infection and a consequent increase in flower production of susceptible varieties; in the field both materials were on the whole ineffective, and therefore healthy cuttings and resistant varieties should be used. Susceptible varieties should be grown in new or well-rotated soil in the field (the required length of rotation is not known) as well as in the greenhouse; when old soil is used in greenhouse benches, it should be disinfected with chloropicrin or formalin.

PAPE (H.). **Untersuchungen über das Schwarzwerden der Maiblumenkeime.** [Studies on the 'blackening' of Lily of the Valley rhizomes.]—*Angew. Bot.*, xxv, 1–2, pp. 29–54, 14 figs., 1943.

Lilies of the valley are extensively grown on a commercial scale in Germany, about ⅓ of the crop being exported at a yearly pre-war value of well over RM. 1,000,000. The destructive 'blackening' disease has long been recognized as serious, but hitherto its etiology has remained obscure. The present contribution deals with the writer's studies, at the newly established flower disease bureau of the Biological Institute, on the cause of the trouble, the control and prevention of which are to be discussed in a forthcoming paper.

The symptoms are most conspicuous in the late autumn and winter in the warehouse and during storage in the boxes prepared for export. The buds are

partially or entirely blackened and the tissues rotted, tending to break off at a touch on the base and revealing a discoloured area with a lighter centre. Infection begins as a small, ill-defined, grey spot, gradually spreading in all directions, though often confined in the early stages to one side of the bud. The primary bud is frequently the only one involved; in other cases this is healthy and the secondary buds are diseased, while yet again all the buds on a rhizome may be attacked. The axes are also liable to infection, showing deep black areas over which the cortical tissue is scabbed and roughened, the rot often extending inwards to the woody central cylinder. The roots are similarly affected. Infection spreads with great rapidity from one rhizome in a bunch to the others, a period of 8 to 14 days sufficing for the contamination of an entire lot.

The percentage of forced marketable flowers produced by the blackened rhizomes ranges from 0 to 50 per cent. according to the intensity of infection. In one-year-old stands in the open, gaps of up to 1·5 m. in length point to the presence of the disease, while in those of two to three years old the occurrence of empty spaces is sporadic, denoting the extension of the pathogen from its original focus to the neighbouring rows.

The fungus isolated from the diseased rhizomes is named *Sclerotium denigrans* n.sp. It grew well on 2 per cent. malt agar and soaked wheat and barley seed-grain (2 : 1), the minimum, optimum, and maximum temperatures for its development being below 2°, 21°, and 32° C., respectively. The organism proved to be highly resistant to cold, withstanding two months' exposure to day temperatures as low as —18°, and also remained viable after eight months' desiccation. *S. denigrans* is characterized by a pale grey mycelium, darkening to fuscous-fuliginous or olive-brown, septate, branched, 2·5 to 9·5 (average 5 to 7) μ in diameter, and two forms of sclerotia, one depressed-spheroid or -ellipsoid, woolly to rugose, dirty grey or black, without a sharply-defined cortex, consisting of loose strands of dark grey hyphae and measuring 0·6 to 1·3 mm. in diameter, and the other subglobose, with a dull black, well-marked cortex and a white, pithy interior, composed of densely interwoven, hyaline, branched hyphae, and measuring 0·3 to 1 mm. in diameter. *S. denigrans* is believed, from a study of the relevant literature, also to attack lilies of the valley in Sweden and Holland. Inoculation experiments gave positive results on wounded and unwounded lilies of the valley, but none of the other 16 plants tested were susceptible.

The writer did not observe that the nature of the soil exerted any particular influence on the course of the disease, but others have reported that the fungus thrives in moorland and old garden soils with a plentiful admixture of humus, and may be checked by rotation with root crops to facilitate thorough aeration. Immediately after harvesting or on delivery the rhizomes should be packed in clean, white sand rather than in soil, while another possibility of combating the disease lies in packing them in moss-lined boxes and storing at —4° to —8°. Autumn planting, in preference to overwintering for setting out in the spring, is also recommended. Considering the ease with which the blackening fungus may be inadvertently introduced into a healthy nursery in an uninfested region on externally sound rhizomes, the sale of material from localities harbouring the pathogen should be prohibited pending the discovery of some commercially practicable method of control.

DIMOCK (A. W.) & OSBORN (J. H.). **An Alternaria disease of Zinnia.**—*Phytopathology*, xxxiii, 5, pp. 372–381, 3 figs., 1943.

A destructive disease of garden zinnias (*Zinnia elegans*), which has been under observation at Cornell University since 1934, is attributed to *Alternaria zinniae* Pape [*R.A.M.*, xxi, p. 492], with which the pathogens reported from England by Beaumont [ibid., xviii, p. 654] and Denmark by Anna Weber and Neergaard [ibid.,

xvii, p. 96] are believed to be identical. The reddish-brown spots on the leaves, sometimes with greyish-white centres on the upper side, range from 2 to 10 (average 5) mm. in diameter. On the petal tissues of the ray flowers the brown spots measure 1 to 2 mm. in diameter and in some cases are also greyish-white in the centre. The affected petals turn dark and wither, thus becoming useless for cutting or as garden specimens. The internodal areas of the stems bear numerous reddish spots, sometimes greyish-white in the centre and rarely more than 1 mm. in width, though often longitudinally elongated; at the nodes, large, deep-seated lesions develop and frequently kill the distal portion of the stem by girdling, which also follows the development of dark brown to black, centrally depressed basal cankers. The cortical tissues of diseased roots turn dark grey, rot completely, and slough off, causing the wilting and death of the plants.

The conidia of *A. zinniae* average 170 to 210 by 20 to 24 μ, inclusive of the beak, which is commonly twice as long as the spore body. Catenulation was not observed in nature, but chains of up to eight spores occasionally developed on material kept for a few days in a dry chamber. At the optimum temperature of 27° C., the fungus grows rapidly on potato dextrose agar exuding a reddish pigment, dependent on the presence of sugars in the medium, as the culture ages. Sporulation was very scanty on all the substrata tested. In inoculation experiments the optimum temperature for leaf infection lay between 65° and 75° F., probably near 70°. The lower leaf surface was more easily invaded than the upper. The fungus was also shown to be capable of entering the stems and roots of its host.

A. zinniae is apparently able to withstand at least one winter in or on the soil, and the available evidence strongly suggests that it is seed-borne. General recommendations for control of the disease, based on its probable pathogenesis, include thorough field and garden sanitation, lengthy crop rotation, the sterilization of implements before use in new plantings, and the fungicidal treatment of seed and seedlings.

CHAMBERLAIN (E. E.) & MATTHEWS (R. E. F.). **A virus disease of cultivated Daphne.**—*N.Z. J. Sci. Tech.*, A, xxiii, 4, pp. 254–256, 3 figs., 1941 (issued 1942).

Daphne odora plants sent to Australia from Levin, New Zealand, in 1938, were rejected by inspectors at the port of entry on account of foliar mottling and returned to their place of origin where they have since been shown to harbour an unidentified transmissible virus which also occurs at Pukekohe, Auckland, and Palmerston North. The pale yellowish mottling may assume the form of an even mosaic or develop in large, irregular patches, tending to follow the veins and sometimes accompanied by distortion of the lamina. The growth of the plants is not affected by the disorder. The virus was readily transmitted by inarch-grafting but only with difficulty by means of leaf-rubbing with the juice of mosaic plants, while it was absent from most of the symptomless shoots on infected plants. Control consists in the striking of cuttings only from healthy plants.

SULLIVAN (J. T.) & CHILTON (S. J. P.). **The composition of White Clover leaves as affected by rust and by sulphur.**—*Phytopathology*, xxxiii, 5, pp. 401–402, 1943.

The analytical data from studies on the influence of leaf rust (*Uromyces trifolii*) [*U. trifolii-repentis*] and the sulphur dust used for its control on the composition of white clover (*Trifolium repens*) foliage [*R.A.M.*, xx, p. 535] indicated that rusted plants were higher in protein and fat and lower in water and nitrogen-free extract than were sulphured plants. Sulphur-treated rust-resistant plants showed increased ash and fibre and decreased protein contents compared with the untreated. Data secured from rusted and non-rusted leaves from the same plant showed that the former were higher in ash, fat, fibre, and nitrogen-free

extract and lower in moisture and protein than the latter. It is evident that sulphur-treated plants are not suitable for use as controls to determine the effects of the rust on chemical composition.

BATEN (W. D.) & MARSHALL (R. E.). **Some methods for approximate prediction of surface area of fruits.**—*J. agric. Res.*, lxvi, 10, pp. 357–373, 3 figs., 8 graphs, 1943.

In investigations on spray coverage and other problems it is sometimes desirable to know the surface areas of the experimental apples used, and in this paper the authors describe mathematical equations they have developed to facilitate the approximate prediction of exposed surfaces or surface areas of different varieties of apples, pears, and plums.

JAHN (E.). **Untersuchungen zur Vorherbestimmung des ersten Spritztermines beim Apfelschorf.** [Studies on the pre-determination of the first spraying date for Apple scab.]—*Angew. Bot.*, xxv, 1–2, pp. 55–78, 3 graphs, 1943.

A tabulated account is given of the writer's experiments at the Biological Institute, Dahlem, Berlin, to test the practicability of Holz's methods for the prognostication of the date of inception of ascospore discharge in apple scab (*Venturia inaequalis*), on which the spraying schedule for a given season is based [*R.A.M.*, xviii, p. 531]. Under outdoor conditions the process was observed to commence a few days after the initial discharge of the spores on overwintered leaves tested in the laboratory; allowance being made for the slight delay, the appropriate dates for spraying could be reliably predicted on this basis.

Perithecia-bearing leaves on vaseline-coated slides require only momentary moistening to induce ascospore discharge, which generally reaches a climax within half an hour and is completed within two hours both at room temperature and at 2° C., except in the case of very desiccated material, when up to three hours may be necessary. It is advisable to bring the leaves into the laboratory the evening before the experiments are to be made, placing them on slightly damp filter paper in moist chambers. The most suitable distance between the slide and the leaf for spore fall is 3 mm. and five diagonal rows of an area of 18 by 18 mm. suffice for the count.

During the three-year period from 1940 to 1942 the aggregate temperature for March was 140° compared with 105° computed by Holz for Stade [Schleswig-Holstein: loc. cit.]. With this difference the perithecia developed according to rule provided that they contained at any rate young asci, but further investigations are needed to determine the conditions for arrival at this stage.

RASMUSSEN (E. J.). **Effect of spray materials on finish and keeping quality of Apples.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxv, 3, pp. 263–271, 3 figs., 1943.

This is a tabulated discussion of the results obtained in experiments carried out in 1937, 1940, 1941, and 1942 to determine the effect of various anti-scab [*Venturia inaequalis*] spraying materials on the finish and keeping quality of apples under Michigan conditions. Bordeaux and proprietary copper-containing preparations were found to produce fruit with a poor finish compared with that of trees treated with lime-sulphur or wettable sulphur when applied in an all-season schedule. Of the varieties tested, McIntosh and Jonathan were the most susceptible to injury from copper, which should not be used at all on the former or for early applications on the latter. Although Delicious and Northern Spy are comparatively resistant to russeting, the exclusive use of copper fungicides is not recommended; if applied in the later treatments, they should be mixed with at least an equal amount of lime. Russeted fruit loses weight faster and shrivels sooner in storage than smooth-finished: on a 1,000-box basis (50 lb. apples per box)

the 12 per cent. loss in Northern Spy of the 1941 crop by 12th March, 1942, would have amounted to 2,185 lb.

PALMITER (D. H.) & HILDEBRAND (E. M.). **The yellow-red virosis of Peach: its identification and control.**—*Bull. N.Y. St. agric. Exp. Sta.* 704, 17 pp., 1 col. pl., 1 fig., 1 diag., 1943.

In this semi-popular bulletin on 'X' disease or yellow-red virosis of peach [*R.A.M.*, xxii, p. 256], the authors state the disease is becoming widespread throughout the north-eastern and north-central states on both peaches and choke-cherries (*Prunus virginiana*). On peach the condition can be recognized by the striking contrast between the affected and healthy branches at midsummer, when the leaves on the affected parts drop off after turning yellow and displaying purplish-red areas which become brittle and fall out. The diseased branches bear no good fruits, but some of the small fruits become mummified and remain on the tree for the whole season. The most conspicuous symptom on chokecherry is the bright yellow to red colour of the leaves from mid-June until frost sets in. Affected plants weaken progressively, tend to form rosettes on the terminal growth, and finally succumb. If diseased chokecherries are allowed to remain in the vicinity, spread through a peach orchard may be very rapid, many orchards being ruined in three or four years. Where chokecherries cannot be controlled by cultivation they should be chemically eradicated [loc. cit.]. No peach variety has been found to be resistant when inoculated with diseased buds, and nectarines, almonds, Bessey cherry, and Hortulana plum have all been successfully inoculated. *P. serotina*, which often grows in association with *P. virginiana*, does not carry the disease. The symptoms on both peach and chokecherry are well illustrated by a coloured plate facing p. 10.

HAHN (G. G.). **Blister rust on Red Currant.**—*Phytopathology*, xxxiii, 5, pp. 341–353, 1943.

For the sake of convenience all cultivated red currants tested for their reactions to blister rust (*Cronartium ribicola*) have hitherto been classed with *Ribes sativum*, the most susceptible member of the group, but in the light of present knowledge of the taxonomic-pathological relationships of certain varieties this conception must be revised and Thayer's classification (*Bull. Ohio agric. Exp. Sta.* 371, 1923) followed. Under this scheme the origin of the cultivated red currant is traced to at least three European species, *R. petraeum*, *R. rubrum*, and *R. sativum* with its var. *macrocarpum*. Varieties comprised within the first-named group are reputed to be highly resistant to, or immune from, blister rust [*R.A.M.*, xix, p. 158]; they include Rivers Late Red, Long Bunch Holland (syn. Holland, Franco-German), Red Dutch, and Viking (immune), and Prince Albert (highly resistant).

The writer's greenhouse inoculation tests on Red Dutch confirmed von Tubeuf's field observations and trials in Germany demonstrating the immunity of this variety [ibid., xiv, p. 666]. The morphological characters of Red Dutch and Viking are very similar and distinguishable during the growing season from those of the common susceptible garden varieties belonging to *R. sativum*. Selections, possibly homozygous for resistance, of rust-immune Vikings, some producing red and others white fruit, are now reported. During the period from 1937 to 1940 there was very little production of teleutosori on the few susceptible individuals among a large population of F_2 Viking seedlings.

London Market, a commercial variety of the small *R. rubrum* group, has been extensively investigated, and forms of it are reported to be semi-immune. This currant was grown from 1935 to 1940 at the Central Experimental Farm, Ottawa, and developed only slight infection in spite of more or less severe attacks on adjacent black currants during the same period. Most of the varieties that have

been tested for resistance belong to the *R. sativum* and its var. *macrocarpum* groups, which include some of the forms now recognized as most susceptible, although in the early 1920's they were widely recommended for cultivation in the United States. The natural early defoliation characteristic of *R. sativum* and its hybrids is probably augmented by the necrosis due to infection by *C. ribicola*.

MEREDITH (C. H.). **The effect of soil and chemical mixtures on the growth of Fusarium oxysporum cubense.**—*Phytopathology*, xxxiii, 5, pp. 398–400, 1943.

Mercury compounds were the most effective of the various chemicals tested for the elimination of *Fusarium oxysporum cubense* in air-dried clay soil at the Glenleigh Laboratory, Friends' College, Highgate, Jamaica [*R.A.M.*, xxi, p. 340], 11 out of 12 being capable of inhibiting the growth of the pathogen at concentrations of less than 1 in 10,000, viz., mercuric ammonium chloride, mercuric carbonate, mercuric chloride, mercuric iodide, mercuric oxide (red and yellow), mercuric sulphate, mercurous chloride, and three mercury dusts. Another nine compounds were more or less effective at 1 in 100 or less, namely, acetic acid, borax, boric acid, cadmium sulphate, iodine, Paris green, phenolphthalein, potassium dichromate, silver nitrate, and thymol, while 55 were of no value for the object in view.

MEREDITH (C. H.). **The antagonism of Actinomyces to Fusarium oxysporum cubense.**—*Phytopathology*, xxxiii, 5, pp. 403, 1943.

A culture of a species of *Actinomyces* collected from a compost heap at Port Maria, Jamaica, was found to be capable of dissolving the mycelium of *Fusarium oxysporum cubense*. When the spores of each organism were mixed together in a Petri dish of 2 per cent. soil-extract agar, lysis was strongly in evidence on the fifth day, by which time only small sections of the *Fusarium* mycelium remained. By the ninth day even these had disappeared, while the *Actinomyces* was making normal growth.

LINFORD (M. B.). **Influence of plant populations upon incidence of Pineapple yellow spot.**—*Phytopathology*, xxxiii, 5, pp. 408–410, 1943.

The author discusses and tabulates the results of a plantation experiment at Honolulu, Hawaii, to determine the relation of plant spacing to the incidence of pineapple yellow spot (probably due to the tomato spotted wilt virus) [*R.A.M.*, xix, p. 483]. The outcome of the test confirmed the hypothesis that viruliferous individuals of the insect vector, *Thrips tabaci*, blown in from a distance, were scattered almost uniformly over the field, giving approximately equal numbers of infections, whereas the percentages of yellow spot are inversely correlated with plant population density. Plots with plants 18 in. apart, having only two-thirds as many plants per unit area as those with 12 in. spacing, would be expected to contract 50 per cent. more infections, a figure agreeing reasonably well with the observed value of 57·6 per cent. The incomplete data from the intermediate spacing of 15 in. further tend to support the view that a lower percentage of yellow spot accompanies dense plant populations [cf. ibid., xxi, p. 103].

LOUW (A. J.). **Studies on Septoria passiflorae n.sp. occurring in Passion Fruit with special reference to its parasitism and physiology.**—*Sci. Bull. S. Afr. Dep. Agric.* 229, 51 pp., 4 pl., 4 figs., 7 graphs, 1941. [Afrikaans summary.]

This is a comprehensive study on a new and destructive disease of passion fruit (*Passiflora edulis* and *P. quitensis*) caused by *Septoria passiflorae* n.sp. at French Hoek and Stellenbosch, in the winter rainfall area of Cape Province. The pathogen attacks the leaves, blossoms, fruits, and skins of the Cape, Perfecta, and Yellow varieties of *P. edulis*, the first-named sustaining the most extensive leaf injury in the form of circular to irregular, light brown, sharply defined, necrotic lesions,

5 to 10 mm. in diameter, surrounded by a yellowish zone which may eventually spread over the entire leaf. Under very humid conditions the typical necrotic spots are replaced by indefinite, water-soaked areas, which turn dull green to black, becoming desiccated and shrivelled. On the blossoms the lesions are similar to those on the leaves; the primary infection of the calyx may extend to the stalks, resulting in the premature shedding of the flowers. The small, superficial, roughly circular, sharply defined, brown spots on the fruits tend to coalesce into large, irregular, necrotic, somewhat depressed patches of a hard consistency. On very young shoots the lesions are small, irregularly circular to elongated, and water-soaked, and young stems may wither and die as the result of girdling by a band of necrotic tissue.

Striking cultural differences in rate of growth, colour (carmine to black), and pycnidial development were exhibited by four isolates of the fungus, designated S1b, S2b, S12c, and S13c, the first from yellow and the others from purple fruits of *P. edulis*. All four isolates made perceptible growth within a temperature range of 5° to 35° C., the optimum lying between 25° and 27·5° for S1b, 27·5° and 30° for S2b, and 20° and 25° for S12c and S13c. In water cultures pycnospores of S2b germinated by microconidial budding.

The pycnidia of *S. passiflorae* are globose or depressed-globose, brown to black, subepidermal in substomatal cavities, 50 to 160 μ in diameter, with a circular to ovoid, slightly papillate ostiole, 15 to 24 μ in diameter, and a pseudoparenchymatous peridium, 2·9 to 6·6 μ thick, with a hyaline inner, and a dark brown outer layer. The hyaline, filiform, irregularly curved or straight, continuous to triseptate, attenuated pycnospores with rounded ends varied slightly in the different isolates, range from 11·3 to 31·3 by 1·1 to 2·6 (mean 18·9 by 1·7) μ for S1b, 11·3 to 33·8 by 1·1 to 2·4 (18·9 by 1·6) μ for S2b, 11·3 to 33·8 by 1·1 to 2·6 (21·1 by 1·8) μ for S12c, and 11·3 to 31·3 by 1·1 to 2·6 (19·3 by 1·8) μ for S13c. The hyaline (pale salmon in the mass), filiform, muticate, straight or irregularly curved conidia, borne in clusters on short, simple, hyaline conidiophores, are rounded at the ends and measure 14·4 to 30·4 by 1·6 to 2·9 (23·2 by 2) μ, and the microconidia are continuous, ovoid, hyaline, and smooth.

In inoculation experiments, S1b and S2b were the most actively parasitic of the four isolates on *P. edulis*, while *P. quitensis* was more severely attacked by S12c; *P. coerulea* is apparently immune. The incubation period was nine days at the most favourable temperatures of 25°, 27°, and 30°, and correspondingly longer at those less conducive to infection, which did not occur at all at 10° or 35°. The stomata, which are present only on the dorsal leaf surface, are the sole channels of entry.

Rainfall and temperature were shown to be the decisive factors in the epidemiology and dissemination of the leaf spot in 1938–9 and 1939–40, the former season being characterized by a moderately cool, rainy period from September to November, followed by protracted drought and heat until May, resulting in a severe outbreak of *S. passiflorae*, and the latter by a predominantly cool spring with intermittent rainy spells, the prevailing temperature (56° to 58° F.) being unfavourable to infection.

Systematic pruning and training of the vines, the removal and destruction of infected material, and the application of a copper-containing dust, such as verderame, at 10- to 14-day intervals, are the proposed control measures.

Nielsen (L. W.). **Studies with silver compounds and mixtures as fungicidal sprays.** —*Mem. Cornell agric. Exp. Sta.* 248, 44 pp., 1 fig., 2 graphs, 1942.

A full account is given of laboratory and greenhouse studies carried out to develop a protective fungicide having silver as the active constituent [*R.A.M.*, xxii, p. 147]. The evaluation of the sprays (70 of which were tested on Chippewa potato plants

inoculated with *Phytophthora infestans*) was based on their fungicidal activity and adhesiveness as estimated by methods [which are fully described] adapted from Hamilton and Weaver (abs. in *Phytopathology*, xxx, p. 7, 1940). The former was determined by inoculating experimental plants previously sprayed on a rotating table at a constant pressure for a definite period with the fungicide and observing the amount of infection that developed; the latter by inoculating plants that had received artificial rain treatment after being sprayed. The most promising results were given by silver oxide, silver iodide, silver hexacyanoferrate (II), silver dichromate, silver dichromate in bentonite, silver sulphite in bentonite, and three silver mixtures containing manganese (II) sulphate, iron (III) sulphate, and iron (II) sulphate, in addition to calcium hydroxide.

Composition studies of the silver nitrate and metal-sulphate mixtures indicated that the best concentration of metal sulphates was one equal to the molecular concentration of the silver nitrate in the respective mixtures. The concentration of the third component, lime, most suitable for maximum adhesiveness of these sprays, differed for each mixture. With the silver and iron (II) sulphate mixture, lime containing sufficient calcium hydroxide to react chemically with the silver nitrate and the iron (II) sulphate gave the most adherent mixture. The relative concentrations of the three components for making this mixture to contain 100 p.p.m. of silver were 0·158 gm. silver nitrate, 0·258 gm. iron sulphate, and 0·154 gm. lime per l. The silver and iron (II) sulphate mixture was the most adhesive of several promising silver sprays, its adhesiveness being about the same as that of Bordeaux mixture (3–3–50). Field tests of the mixture were not undertaken and under such conditions it is possible the spray will not give adequate control. As regards the cost of the spray, 1 lb. silver nitrate would suffice for about 750 gals., and at $6 to $7 per lb. for the silver nitrate the spray would work out at approximately 1 cent. per gal.

MARCUS (O.). **Über das Vorkommen von Mikroorganismen in pflanzlichen Geweben (nach Untersuchungen an Früchten und Samen).** [On the presence of microorganisms in plant tissues (from observations on fruits and seeds).]—*Arch. Mikrobiol.*, xiii, 1, pp. 1–44, 5 figs., 1942.

The author fully describes and tabulates the results of his experiments at the University of Göttingen on the bacterial, fungal, and yeast contents of normal fruits and seeds of a number of cultivated plants [cf. next abstract]. Up to 93 per cent. of the juniper berries examined were found to harbour *Hormodendrum chlorinum* var. *nigrovirens* or *Alternaria tenuis*, the incidence of the former being high and that of the latter low. *A. tenuis* was also a frequent occupant of summer wheat and of barley, and occurred sporadically in the cores of otherwise entirely healthy-looking apples, accompanied by *Phyllosticta tirolensis* Bubák. *A. secalis* was commonly detected in rye, which also occasionally harboured *H.* [*Cladosporium*] *herbarum*. *Fusarium graminearum* [*Gibberella zeae*] was sparsely represented in barley, and *H. chlorinum* var. *nigrovirens* and *Cephalosporium acremonium* in oats. Only 5·8 per cent. of the gooseberries inspected were colonized by microorganisms, including *Torulopsis albida* and a species of *Rhodotorula*. *R. glutinis* was an occasional occupant of sour cherries, *Clasterosporium obovatum* was common in *Crataegus oxyacantha*, and vegetable marrows were frequently invaded by *Bacillus vulgatus*, a parasite of the stigmas which does not penetrate deeply into the fruit, and sporadically by *Corynebacterium brunneum*, *H. olivaceum*, and *Acrostalagmus cinnabarinus*.

Discussing the interpretation of his observations, the writer finds no indication of a symbiotic relationship between the micro-organisms and their hosts in any of the cases investigated, some of which, indeed, are indicative of inhibited or suppressed parasitism. Among these are the inhabitants of the cereal seed-grain

(100 per cent. colonization), which were strictly confined to the weakened pericarp tissues, and those of juniper, *Crataegus oxyacantha*, *B. vulgatus* in vegetable marrow, and *P. tirolensis* (a pathogen of stored fruit) in apple. The potential role of the organisms as stimulants to growth requires further investigation.

NIETHAMMER (ANNELIESE). **Hefen sowie mikroskopische Pilze aus Blüten, ferner von Samen und Früchten.** [Yeasts and microscopic fungi from blossoms, and also from seeds and fruits.]—*Arch. Mikrobiol.*, xiii, 1, pp. 45–59, 1943.

The author records the occurrence of anascosporogenous yeasts and other fungi in the nectars of various flowers and in the 'sterile' [apparently healthy] flesh of numerous fruits, seeds, seed coats, and flowers.

CROEN (E.). **Mildewproofing treatments for textile fabrics.**—*Cotton, Atlanta*, cvii, 2, pp. 104–107, 118, 1943.

This is a useful review of recent developments in the United States in connexion with the treatment of textile fabrics for mildew prevention, with special reference to military requirements, the government specifications for various standardized processes being quoted. Among the procedures described are those involving the use of copper naphthenate, ammonium fluoride, copper substitutes, e.g., zinc naphthenate and salicylanilide, phenolic substances, and certain water- and mildew-proofing combinations in which the fungicidal element is usually supplied by copper stearate. Methods of testing the efficacy of the treatment by inoculation of the experimental fabrics with *Chaetomium globosum* [*R.A.M.*, xxii, p. 73] or soil burial are also discussed.

HOPKINS (C. J. F.). **A descriptive list of plant diseases in Southern Rhodesia (and their control). Supplement I. January, 1940, to April, 1943.**—*Rhod. agric. J.*, xl, 3, pp. 178–192, 1943.

This list, which supplements that published in December, 1939 [*R.A.M.*, xxi, p. 213], includes all new records made since that date, together with a number of corrections and emendations. Many virus diseases are noted, and the local hosts of tobacco kromnek [ibid., xix, p. 620] are given in an appendix.

QUINTANILHA (A.). **Doze anos de citologia e genetica dos fungos.** [Twelve years of cytology and genetics of the fungi.]—*Agron. lusit.*, iii, 4, pp. 241–306, 3 pl., 3 figs., 8 diags., 3 graphs, 1941. [French summary.]

This is a survey, accompanied by critical references to the relevant literature, of the studies carried out by the writer on the cytology and genetics of fungi during the twelve years since his initiation into the subject by Kniep in 1928.

THOMAS (R. C.). **Composition of fungus hyphae IV : Phytophthora.**—*Ohio J. Sci.*, xliii, 3, pp. 135–138, 1943.

The author's analyses of the hyphal structure and composition of the following nine species of *Phytophthora* [cf. *R.A.M.*, xxi, p. 344] are described: *P. cactorum*, *P. parasitica*, *P. infestans*, *P. capsici*, *P. hydrophila*, *P. pini*, *P. cinnamomi*, *P. melongena*, and *P. citrophthora*. A basic skeleton of chitin was found to have superimposed upon it a mixture of two forms of cellulose, of which one was doubly refractive in polarized light. These were impregnated with fatty acids, which had to be saponified with alcoholic potash before the cellulose could be removed by solution in ammoniacal cupric hydrate. The outside layer consisted of a carbohydrate mixture responding positively to the orcinol-hydrochloride test for pentoses, the presence of a hexose also being indicated. Viewed in polarized light, both young and old cultures of *P.* spp. present an identical, dimly anisotropic appearance, in striking contrast to those of *Pythium*, which are isotropic in the initial stages.

Reed (H. S.). **A short history of the plant sciences.**—vi+320 pp., 34 figs., 1 map, Waltham, Mass., Chronica Botanica Company, 1942. £1. 10*s*.

Included in this manual (Volume VII of a new series of plant science books edited by F. Verdoorn) are chapters on mycology, plant pathology, plant nutrition, and mineral constituents in metabolism. The aspects of these topics discussed comprise, *inter alia*, early works on fungi, the initiation of the scientific period, Pasteur's work, physiologic specialization and heterothallism, biochemistry, mycorrhiza, an epoch of discoveries (1750 to 1850), an epoch of expansion, forest pathology, bacterial diseases, virus diseases, and the control of plant diseases.

Kotte (W.). **Der Pflanzenschutz im Elsass.** [Plant protection in Alsace.]—*Angew. Bot.*, xxv, 1–2, pp. 1–12, 1943.

In connexion with the reorganization of plant protection in Alsace under German administration, a description is given of the topographical, climatic, and agricultural features of the province, of which some 60 per cent. of the total area of 8,300 sq. km. is under cultivation, largely by small farmers with an acreage of under 5 ha. Among the achievements attributed to the German authorities are the substitution of up-to-date seed-grain disinfection for treatment with copper sulphate, and the elimination of potato wart [*Synchytrium endobioticum*] from the foci of infection in the Vosges mountains by the substitution of the German immune varieties for the susceptible French sorts formerly cultivated by the peasantry. 'Degeneration' in the low-lying districts is of the same order of importance as in Baden, and the regular provision of high-grade seed stocks from the mountains is indispensable. The treatment of beet field soils with boron against heart and dry rot has been initiated. The most destructive tobacco disease is wildfire [*Pseudomonas tabaca*], and hops are subject to downy mildew (*Peronospora*) [*Pseudoperonospora humuli*].

Rivers (T. M.), Stanley (W. M.), Kunkel (L. O.), Shope (R. E.), Horsfall (F. L.), & Rous (P.). **Virus diseases.**—Ithaca, New York, Cornell University Press, 1943. $2.00. [Reviewed by T. Francis in *Science*, N.S., xcvii, 2528, pp. 535–536, 1943.]

In this volume of lectures given at Cornell University in 1942 W. M. Stanley discusses the chemical structure and mutation of viruses, and describes his efforts to induce mutants or variants of tobacco mosaic by chemical changes in the virus protein [cf. *R.A.M.*, xxi, pp. 50, 229]. Certain strains of the virus differ in their content of amino acids and it was suspected that the variations in behaviour were related to these differences. Virus chemically modified by extensive coverage of the amino and phenol groups was therefore inoculated into susceptible plants in the hope that the virus produced in the plant would resemble the inoculum. This was not so, for the resultant virus was similar in almost all respects to the usual tobacco mosaic, though virulence for a different host was decreased. Chemical treatment beyond a certain point destroyed activity. L. O. Kunkel discusses the advantage obtained for research purposes by transmitting plant viruses to new hosts.

Rosendahl (R. O.) & Wilde (S. A.). **Occurrence of ectotrophic mycorrhizal fungi in soils of cut-over areas and sand dunes.**—*Bull. ecol. Soc. Amer.*, xxiii, 4, pp. 73–74, 1942.

To verify the assumption that the frequent failure of reforestation by means of direct seeding in soils of old cut-over areas and sand dunes is attributable to the absence of mycorrhizal fungi, an experiment was carried out in the sandy area of central Wisconsin, in which Jack, red, and white pines [*Pinus banksiana*, *P. resinosa*, and *P. strobus*] were sown on plots, protected by wire screens, in

abandoned fields, forested areas, prairie soils, and the like, and in the greenhouse on samples from such soils. Fungi capable of producing mycorrhiza on these species were found to be present in varying numbers in the soils of cut-over areas, including wind-blown sands with a denuded humus layer and fields that have been under cultivation or grazing for periods up to 60 years. Some such soils were located as far as two miles from the boundary of the present forest. Mycorrhizal fungi were invariably absent from the adjacent areas of prairie soils of similar sandy texture. Periodical droughts and damping-off fungi were responsible for widespread seedling failure in field trials.

FRIES (N.). **Über die Sporenkeimung bei einigen Gasteromyceten und mykorrhizabildenden Hymenomyceten.** [On spore germination in certain Gasteromycetes and mycorrhiza-forming Hymenomycetes.]—*Arch. Mikrobiol.*, xii, 3, pp. 266–284, 5 figs., 1941.

In experiments at the Institute for Physiological Botany, Upsala, to determine the conditions for spore germination for certain Gasteromycetes and mycorrhiza-forming Hymenomycetes [*R.A.M.*, xxi, p. 389], it was found that a 'wild' yeast species 'X' induced germination in otherwise sterile species of *Lycoperdon* and *Tricholoma*, *Scleroderma aurantium*, *Boletus granulatus*, and *B. luteus* on malt agar.

Under dry conditions the spores of *L. umbrinum* and *S. aurantium* remain viable for at least 22 and 7 months, respectively, while those of *B.* and *T.* spp. appear to be comparatively short-lived.

FRIES (N.). **Vitamin B_1, vitamin B_6 and biotin as growth substances for some Ascomycetes.**—*Nature, Lond.*, clii, 3847, p. 105, 1943.

Continuing his earlier investigations [*R.A.M.*, xviii, p. 335], the author found that all of nine species of *Ophiostoma* (*Ceratostomella*) examined required one or more growth substances to grow on synthetic media [ibid., xxii, p. 218]. At least six species reacted positively to an addition of vitamin B_6 (adermin, pyridoxin), and of these four showed inability to synthesize vitamin B_6. *C. multiannulata* required both B_1 and B_6. Within a number of species B_1-heterotrophy occurred, in one case, *C. pini*, combined with biotin-heterotrophy. In most cases it was unnecessary to add the whole B_1 molecule; supplied with pyrimidin only, the organism produced the thiazole necessary for the synthesis of B_1. Any two species of which one required B_1 but produced B_6, while the other required B_6 but produced B_1, were able to grow together without added growth substances. The lowest concentration of B_6 that was effective was about 10^{-10}. *C. multiannulata*, with the addition of suboptimal amounts of B_6 to a nutrient solution otherwise optimal, produced quantities of mycelium which, within certain limitations, were directly proportional to the amounts of B_6 added. The same held good for *C. ulmi*. Other Ascomycetes examined generally proved to be auxo-autotrophic or B_1-heterotrophic.

Potato spraying and dusting machinery.—*J. Minist. Agric.*, l, 4, pp. 186–187, 1943.

Notes are given on the proper care of potato spraying and dusting apparatus.

PUSHKARNATH. **Good seed Potatoes and how to produce them.**—*Indian Fmg*, iv, 1, pp. 14–17, 4 figs., 1943.

The degeneration of seed stocks due to virus diseases [*R.A.M.*, xix, p. 134] is stated to be one of the most serious problems of seed potato production in India. The most important diseases of this group are leaf roll and mosaic, prevalent both in the hills and the plains, and streak, common on the variety Up-to-Date in the hills of northern India. To obtain healthy seed potatoes the planting of seed plots and the use of suitable varieties and healthy tubers are advocated. It is suggested

that a system of seed certification on the lines of schemes operating in America and many European countries is urgently needed in India.

BALTZER. **Aufgaben der Saatguterzeugung im Kartoffelbau.** [Requirements for seed production in Potato cultivation.]—*Mitt. Landw., Berl.*, lviii, 7, pp. 107–109, 1943.

The responsible authorities have now recognized that the control of potato 'degeneration' diseases is the first step towards the production of sound seed stocks, and with this end in view the planting of peach trees, the alternate host of the aphid vector of the leaf roll, Y-, and A-viruses, has been prohibited in the eastern provinces for the last two years [*R.A.M.*, xxii, p. 268]. Existing peach and apricot stands must be sprayed according to the prescribed schedules for the districts in question. Energetic measures have lately been adopted for the elimination of 'degeneration' from Pomerania, where climatic conditions are ideal for healthy seed production but innovations are strongly resisted by the conservative smallholders and peasantry. As from 1943 the potato varieties sanctioned for cultivation are determined by the local seed-producing concerns, which are then responsible for the annual supply of fresh seed to the growers, a triennial rotation being observed.

Up to 1937 the proportion of 'degenerate' plants allowed in certified seed stocks was 5 per cent., whereas to-day the maximum is 0·4 per cent., reflecting an increasingly stringent tendency in the matter of registration on the part of virus experts: for certified second-year seed the corresponding figures for classes A and B are 0·6 and 1·2 per cent., respectively. During the five years since these changes have been in operation, the health of the seed stocks has markedly improved, and in 1942 only 5 per cent. of the Pomeranian stands submitted were refused certification or withdrawn.

BLACK (L. M.). **Some relationships between Potato yellow-dwarf virus and the Clover leaf hopper.**—*Phytopathology*, xxxiii, 5, pp. 363–371, 1943.

Clover leafhopper (*Aceratagallia sanguinolenta*) nymphs in the third, fourth, and fifth instars transmitted the potato yellow dwarf virus [*R.A.M.*, xvii, p. 412; xxi, p. 264] in many of the author's experiments, while one case of conveyance by a second-instar nymph is also recorded. No significant difference in mortality between viruliferous and non-infective insects was observed. The incubation period of the virus in crimson clover (*Trifolium incarnatum*) plants varied from one to five weeks, most of the plants developing symptoms during the second and third weeks after one week's feeding or inoculation. The incubation period in the insect ranged from six to ten days (probably longer in individual nymphs). Clover seedlings may be infected by individual insects daily for at least ten days, but a lapse of many days (up to 25 in one instance) is common between two transmissions by the same insect. Nymphs transferred daily to fresh, healthy clover plants retained their infectivity for as long as 44 days, the corresponding period for those fed on rye being 52. The virus was not communicated from viruliferous parents to their progeny through the eggs or sperm.

BLACK (L. M.). **Genetic variation in the Clover leafhopper's ability to transmit Potato yellow-dwarf virus.**—*Genetics*, xxviii, 3, pp. 200–209, 1943.

Selective breeding through ten generations resulted in the development of two races of the clover leafhopper, *Aceratagallia sanguinolenta* (Prov.), one 'active' and the other 'inactive'. In the last generation 80 per cent. of the 'active' race, 2 per cent. of the 'inactive', and 30 per cent. of the hybrids proved to be capable of transmitting the yellow dwarf virus from crimson clover (*Trifolium incarnatum*) to potato under comparable conditions [see preceding abstract]. Viruliferous

individuals appeared in the 'inactive' race in every generation, while conversely, some members of the 'active' race failed to carry the virus from one host to the other. A slightly but significantly higher percentage of males (43) than of females (38) transmitted the virus, and the former sex was also more 'efficient' (i.e., conveyed the disease to a larger number of plants) than the latter. Evidence was further obtained that the males derived from crosses between 'inactive' males and 'active' females were more 'active' than the females of the same origin or than individuals of both sexes produced by reciprocal crosses.

RAMSHORN (K.). **Über die Wirkung von β-Indolyl-essigsäure auf den sogenannten Kartoffelabbau.** [On the effect of β-indole-acetic acid on the so-called Potato degeneration.]—*Forschungsdienst, Sonderh.* 16, pp. 378–384, 1942. [Abs. in *Chem. Zbl.*, cxiii (i), 21, p. 2725, 1942.]

A deficiency of growth substance being indicated by the unthrifty condition of 'degenerate' potatoes, heteroauxin was administered with the object of promoting vigorous development in the progeny [*R.A.M.*, xvi, p. 705]. The resultant striking improvement in the growth habit and yield of the second-year plants is attributed to the increased mobility of the reserve substances, especially the carbohydrates.

KÖHLER (E.). **Über die unterschiedliche Vermehrungsgeschwindigkeit von Stämmen des Kartoffel-X-Virus.** [On the differential rate of multiplication of strains of the X-virus of Potato.]—*Zbl. Bakt.*, Abt. 2, civ, 23–24, 1 graph, 1942.

The three highly necrotic strains (variants) of the X-virus of potato known as Us, Cs 37, and Bf [*R.A.M.*, xxii, p. 109] were found to multiply at varying rates in inoculated leaves of Samsun tobacco. In one test, by the fifth day of incubation, Us was capable of producing a total of 1,135 single lesions on the leaves of five White Burley tobacco plants, the corresponding number of Cs 37 being only 157, while Bf was not sufficiently advanced for use. In another experiment, in which the three strains were inoculated, a week after incubation, into four Samsun and two White Burley plants, the numbers of lesions produced on the former by Us, Cs 37, and Bf were 319, 552, and 65, respectively, and on the latter, 442, 568, and 154, respectively. The results of a preliminary test had shown that the infection density ratios of the three isolates on Samsun were 159·3: 85·3: 49·8 for Cs 37, Us, and Bf, respectively.

DIMOND (A. E.), HEUBERGER (J. W.), & HORSFALL (J. G.). **Copper spray substitutes.**—*Amer. Potato J.*, xx, 6, pp. 141–153, 1943.

This is a summary of available knowledge of copper spray substitutes for the control of potato diseases, based chiefly on the authors' general experience with new organic materials since 1938. Of the new compounds already on the market, tetrachlorquinone (spergon), tetramethylthiuram disulphide (thiosan and Du Bay 1205 FF), and ferric dimethyldithiocarbamate (fermate, Du Bay 870, and IN-870) have all been proved to give excellent disease control as seed protectants and as foliage sprays in the field on several crops. In addition, there exists a number of other promising materials not yet on the market. The disadvantages of the copper substitutes are their high cost, limited production, high specificity, and low tenacity, but it is believed that further research might show the way of overcoming all or some of them.

BONDE (R.) & SCHULTZ (E. S.). **Potato refuse piles as a factor in the dissemination of late blight.**—*Bull. Me agric. Exp. Sta.* 416, pp. 229–246, 8 figs., 1943.

In this paper the authors give a summarized account of their attempts to determine the primary sources of the infection of potatoes by late blight (*Phytophthora infestans*) in Maine. In the concentrated potato area of Aroostook County the

annual loss from infection ranges from 2 to 15 per cent. of the total crop. In Maine as a whole the annual loss is about 9 per cent. of the total crop, or nearly 4,000,000 bush., in spite of the fact that farmers spend at least $1,000,000 a year on spraying and dusting against the disease.

From 1935 to 1940 the authors attempted to induce epidemics of late blight experimentally by planting diseased seed potatoes in a number of fields. Of 1,410 diseased seed pieces planted, only four produced affected shoots; none of the diseased plants gave rise to an epidemic, and the infected sprouts soon died. In the past two seasons an experimental plot was planted with late blight-infected tubers, the parts showing decay due to other organisms being cut away. Only 4 per cent. of the infected tubers gave rise to late blight-infected shoots. While the disease may sometimes develop as a result of planting infected seed potatoes, this does not seem to be the chief source of infection locally.

In one instance late blight was observed to spread from an infected potato refuse pile to an unsprayed potato field about 200 ft. away. The plants nearest the pile were almost all infected, but incidence decreased as the distance from the pile increased, and very few spots were seen on plants 500 and 600 ft. away. Data obtained in extensive surveys showed that late blight often develops on the plants growing in the cull piles in the early part of the season, before most growers have started spraying. Conditions in the damp piles are very favourable to infection, because a dense mass of vines remains moist and humid for long periods, whereas under normal field conditions the diseased shoots often die before secondary infections can arise. Further, large numbers of infected tubers are concentrated in the cull piles, and the lack of soil over infected tubers at or near the surface of the pile favours emergence and exposure of the young shoots to infection.

In April and May, 1938, about 25 barrels of cull potatoes were deposited in a pile 100 ft. from a potato field. Records of the prevalence of late blight in the field at different distances from the infected refuse pile were taken on 12th July and showed that at distances of 100, 200, 300, 400, 500, and 600 ft. away there were, respectively, 98, 55, 21, 6, 0, and 1 per cent. infected plants, with, respectively, 293, 98, 31, 9, 0, and 1 lesions per 100 plants. In July, 1942, five fields in the vicinity of infected dump piles were examined. At distances of 100 ft. or less, 100 to 200, 300 to 400, 500 to 600, and over 600 ft. from the piles, the first field showed, respectively, 23, 5, 1, 2, and 0 per cent. diseased hills, the second 40, 8, 0, 0, and 0 per cent., and the third 56, 7, 0, 0, and 0 per cent., the fourth 19, 3, 0, 0·5, and 0 per cent., and the fifth 83, 15, 4, trace, and 0 per cent. Spread was mostly towards the north-west, indicating that the conidia had been carried by winds from the south-east.

Drifting mist and fog and wind-blown rains in humid regions are favourable agents for the dissemination of the spores and for the spread of infection. In Aroostook County the disease, when first observed in the field, usually appears as isolated small spots on the top leaves or stems, indicating that single conidia have been carried in from a distance. As a rule, infection appears in this way at about the same time in a number of fields spread over a large area, and this also indicates wind dissemination. In 1936 an acre of unsprayed potatoes were sprinkled on 18th July with inoculum from 50 leaves. The weather was moist but cool, and no symptoms appeared until 24th July. A misty rain and fog accompanied by wind from the south-east prevailed for some days after the spores had developed and almost every plant in an adjacent field for a distance of 500 ft. from the south-eastern edge of the field became infected. No disease was found in the unsprayed fields lying in other directions, or in the fields sprayed shortly before 24th July.

The authors conclude that waste potatoes should not be dumped at all; they should be boiled, burned, incinerated, or fed to livestock.

Potato ridging and Potato blight.—*Gdnrs' Chron.*, Ser. 3, cxiii, 2946, p. 234, 1943.

The manner in which potatoes are earthed up may considerably affect the incidence of blight [*Phytophthora infestans*] at the end of the season. When the fungus develops about August, the spores are washed down by rain from the leaves to the soil. A wide ridge with a hollow at the top tends to catch the rain, which may then carry the inoculum down through cracks in the soil until it comes into contact with the tubers. A well-pointed ridge, on the other hand, throws the rain off the sides, and the spores are more likely to be filtered out from rain soaking down to the tubers through a good covering of soil.

SAMUEL (G.). **Guarding against blight in Potato clamps.**—*J. Minist. Agric.*, l, 5, pp. 214–216, 1943.

The following recommendations are given for the control of potato blight [*Phytophthora infestans*]. Precautionary measures, in addition to spraying, should consist in (1) growing resistant varieties, such as Majestic or Arran Banner, (2) early planting to get maximum growth before the appearance of the disease, and (3) good ridging to protect the tubers in the soil [see preceding abstract]. Spraying, which is the chief control measure, should be made a routine practice in the Fenlands and the south-west of England where blight appears early in the season; an additional treatment in seasons when blight is prevalent is of great value. To clamp a sound crop it is advisable to wait at least ten days after the tops had been completely killed off by the disease before lifting, in order to prevent contamination of sound tubers with fungal spores from the haulm. Where a delay in lifting is impracticable, the haulm should be burnt off before lifting, or, in the case of small fields, cut by hand and carted off. The best method of haulm destruction is spraying with sulphuric acid, but as the handling of acid is difficult and requires special equipment, it is not recommended for general use. Fairly good results were obtained in small-scale tests with two other substances: (1) a mixture of crushed or granulated copper sulphate and salt at a strength of 2 or 3 per cent. of each, and (2) tar oil winter wash, as used for spraying fruit trees. Both are recommended for trial on a field scale, and the farmers requested to send in brief reports on the results to the author. Another method of avoiding infection of the tubers from blighted haulms is to lift the crop during a spell of dry weather, as the blight spots on the leaves tend then to dry up somewhat and spore less freely. This method, however, is more suitable for the lifting of earlies and early maincrops for immediate sale than for storage in clamps.

RICHARDS (O. W.). **The Actinomyces of Potato scab demonstrated by fluorescence microscopy.**—*Stain Tech.*, xviii, 2, pp. 91–94, 1 fig., 1943.

The agent of potato scab, *Actinomyces scabies*, was shown by experiments at the Spencer Lens Co., Buffalo, New York, to be susceptible of selective impregnation with carbol-auranin and to fluoresce bright yellow on exposure to ultra-violet radiation. The staining technique is carried out at room temperature and no counter-stain is used. This method confirms Lutman's conclusion that the hyphae of the fungus are intercellular and grow within the middle lamellae [*R.A.M.*, xxi, p. 156]. After complete removal of the paraffin the sections are stained four minutes in carbol-auranin, washed, de-stained in a 0·5 per cent. solution of sodium chloride in 70 per cent. alcohol with 0·5 ml. hydrochloric acid per 100 ml., washed, and mounted in glycerine.

DÉFAGO (G.) & GASSER (R.). **La dartrose de la Pomme de terre.** [Potato dartrose.] —*Ber. schweiz. bot. Ges.*, liiiA, pp. 480–499, 4 pl., 1 graph, 1943.

In 1937, and again in 1941, 'dartrose' (*Colletotrichum atramentarium*) was

responsible for heavy losses among the potato crops in various parts of the canton of Valais, and is stated to be, in general, a frequent concomitant of hot summers in Switzerland. The somewhat nondescript symptoms of the disease tend to complicate its diagnosis. In pure culture on potato agar several races of the fungus could be differentiated on the basis of the size and density of the sclerotia, the colour of the conidial masses, the pigment diffused through the medium, and other peculiarities. The dimensions of the conidia ranged from 15 to 27 by 3 to 5·6 μ, while three isolates further yielded ovoid microconidia, 7 to 8 by 4 to 5 μ. The sclerotia measured 0·06 to 3 mm. in diameter, and some were furnished with blackish, acicular, pluriseptate setae, 40 to 250 (average 130 to 160) μ in length.

In an exclusively synthetic solution *C. atramentarium* was found to be completely auxo-autotrophic in respect of aneurin. The optimum temperature for growth lies between 28° and 30° C., the minimum and maximum being 6° and 38°, respectively. Sectoring of the type described by Hiroe for *Ophiobolus miyabeanus* and other fungi [*R.A.M.*, xvii, p. 337] was observed in agar cultures. The inoculation of plants and tubers with the agent of 'dartrose' was successful only on young material and at fairly high temperatures (above 21° for plants and between 26° and 32° for Eersteling [Duke of York] tubers. Tomatoes were also susceptible at temperatures above 20°.

Direct control of *C. atramentarium* is thought to be impracticable. Diseased tubers should be isolated or disinfected as for *Rhizoctonia* [*Corticium solani*], and the aerial portions of the plants burnt or deeply buried.

Douchez (Mlle Y.). **Sur les galles des racines de Pomme de terre provoquées par le Spongospora subterranea (Wallr.) T. Johnson.** [On the Potato root galls induced by *Spongospora subterranea* (Wallr.) T. Johnson.]—*Ann. Inst. Pasteur*, lxviii, 4–6, pp. 351–353, 1942.

The writer studied the histogenesis of the potato root galls produced by *Spongospora subterranea*. From the moment of entry of the plasmodium into the host the cortical cells are disorganized, while those of the phloem and cambium, invaded in their turn, undergo hypertrophy and attain six or seven times their normal size, at the same time losing their specific characters and giving rise to a compact, undifferentiated, large-celled parenchyma which constitutes the basic tissue of the tumour. Before the penetration of the fungus the host nucleus swells and the cells are then rapidly invaded by plasmodia, the nuclei of which encircle the nucleus of the host. The latter, together with the large quantity of starch in the cytoplasm, is ingested by the plasmodium. In the deeper layers of the tumour tissue the starch is much less plentiful and the plasmodia are replaced by sporangia. The hypertrophied phloem and cambium cells displace the xylem and proceed for a considerable distance into the misshapen fibro-vascular cylinder in the centre of the root. The disturbances consequent on this process tend to dislocate the cambial layer, the aberrant cells of which ultimately produce woody or phloem elements; sieve-tubes or vessels may, in fact, be scattered through the tumour tissue.

Not only do the plasmodia induce hypertrophy in the invaded cells themselves, but they act similarly on those at a distance, causing hyperplasia of the cambial tissue and disorientation of the phloem and xylem arising from it. In none of these newly formed elements is the parasite actually present, but certain hypertrophied cells in proximity to the root were occupied by myxamoebae, the origin of which is at present obscure.

Sherf (A. F.). **A method for maintaining Phytomonas sepedonica in culture for long periods without transfer.**—*Phytopathology*, xxxiii, 4, pp. 330–332, 1943.

Slants of Burkholder's medium were inoculated with 16 cultures of *Phytomonas*

sepedonica [*Corynebacterium sepedonicum*], the causal organism of potato ring rot, and covered ten days later with a layer of sterile mineral oil, the tubes then being plugged with cotton and held at room temperature. Viability was tested at monthly intervals by the removal of a 2 mm.-loopful of cells, which were incubated on a fresh agar slant for 14 days. After ten months under oil 10 (62·5 per cent.) of the cultures were still in a vigorous condition, and at the end of $1\frac{1}{2}$ years four (25 per cent.) were viable and induced the typical ring-rot symptoms on leaves and tubers. In another series of ten cultures placed under oil three months earlier than the preceding, only two out of eight (two had been meanwhile lost through fungal contamination of the oil) were still viable after 17 months, while at the end of $1\frac{3}{4}$ years all were dead.

Phytomonas [*Pseudomonas*] *medicaginis* var. *phaseolicola* and *Phytomonas* [*Xanthomonas*] *phaseoli*, the agents of halo and common blight of beans [*Phaseolus vulgaris*], respectively, retained their viability and pathogenicity for at least 13 to 18 months under oil, and *Fusarium* [*solani* var.] *eumartii*, *F. avenaceum*, *F.* [*bulbigenum* var.] *lycopersici*, and *Alternaria* sp. for a minimum period of six months.

Kreutzer (W. A.) & McLean (J. G.). **Location and movement of the causal agent of ring rot in the Potato plant.**—*Tech. Bull. Colo. agric. Exp. Sta.* 30, 28 pp., 5 figs., 1943.

Infection of the cut surfaces of potato tubers by *Phytomonas sepedonica* [*Corynebacterium sepedonicum*] was reduced by apparent suberization and cork formation occurring in a 24- to 48-hour period. The removal of a layer of tissue 5 mm. in thickness from the cut ends of knife-inoculated tubers greatly reduced the resultant infection (from 84·6 to 3·3 per cent.). Plants arising from tubers painted over the unbroken surface with a suspension of *C. sepedonicum* developed no infection in the greenhouse and very little in the field, whereas the same treatment applied to injured surfaces caused fairly heavy infection. Tubers in which typical ring-rot symptoms were evident produced diseased sprouts earlier than those artificially inoculated or naturally infected ones showing no symptoms. The lower portions of diseased vines developing from both naturally and artificially infected tubers usually contained greater numbers of bacteria than the upper parts. *C. sepedonicum* was also more prevalent in the roots than in the stolons. Some vines of severely infected plants showed little or no infection and the tubers from such plants produced a healthy new growth. The migration of the pathogen took place principally in the xylem elements, whence escape into the adjoining parenchymatous tissues was frequent.

Infected tubers, with or without recognizable ring-spot symptoms, and uninfected tubers were produced by diseased plants, while tubers showing no symptoms frequently failed to reveal the presence of the organism when subjected to the Gram-stain technique but later gave rise to infected vines. In other symptomless tubers the bacterium was often encountered at one point only in the vascular cylinder. However, tubers actually showing ring-rot symptoms gave a Gram-positive stain reaction and, if they did not rot, invariably produced diseased vines.

Neither pure cultures of *C. sepedonicum* nor material taken from the necrotic, yellow rings of affected tubers induced soft rot on inoculation into sound tubers, but inoculum from the completely disorganized tuber tissues did so. Slices from tubers attacked by *C. sepedonicum* tended to decay more rapidly on inoculation with *Erwinia carotovora* than similarly treated slices free from ring rot.

In comparative inoculation experiments on Bliss Triumph potato and Bonny Best and Earliana tomato, *C. sepedonicum* was found to move more rapidly in the latter than in the former, and invariably in a downward direction except where the stem was completely removed and a new terminal shoot produced: in such cases the tissue of the fresh growth was usually found to contain bacteria. The

movement of the pathogen was extremely slow, 45 days being required for its progression from the upper leaves or stem to the underground parts.

MARTEN (E. A.), LOWTHER (C. V.), & LEACH (J. G.). **A differential medium for the isolation of Phytomonas sepedonica.**—*Phytopathology*, xxxiii, 5, pp. 406–407, 1 fig., 1943.

In attempted isolations of *Phytomonas sepedonica* [*Corynebacterium sepedonicum*] from severely rotted potato tubers, the pathogen is apt to be overgrown by secondary organisms of the soft-rot type, and a differential medium has therefore been devised to overcome this difficulty. It is based on Mallmann's observation (*J. Bact.*, xlii, p. 295, 1941) as to the inhibition of Gram-negative bacteria by potassium dichromate, which permits the growth of Gram-positive species. The basic ingredients are Burkholder's medium [*R.A.M.*, xviii, p. 53] and a 1 in 1,000 solution of C.P. potassium dichromate, which are prepared in separate flasks and sterilized. A heavy suspension of the yellowish exudate from the ring-spot lesion is made in sterile water, from which loop dilutions are made to a series of duplicate plates. The liquefied agar, cooled to 50° C., is mixed with the potassium dichromate in dilutions, e.g., of 1 in 9,000, 1 in 12,000, and 1 in 15,000, some 10 ml. of the medium being poured over the bacterial suspension and thoroughly mixed. The cultures are incubated at 22° in a moist chamber, and after seven to nine days, pin-point colonies of the bacteria begin to develop in the agar.

PALM (B.). **Ett konidieliknande vilstadium hos en Fomes-art.** [A conidium-like resting stage in a *Fomes* species.]—*Svensk bot. Tidskr.*, xxxvii, 2, pp. 200–201, 2 figs., 1943.

Attention is drawn to the development in pure cultures of *Fomes lamaoensis*, a virulent pathogen of tea and *Hevea* rubber roots in the tropics, of a hitherto unrecorded conidium-like stage. On the mycelium in culture oidia are first produced, apical cells of individual hyphae becoming detached from one another in the usual way by the dissolution of the middle lamella. Such oidia are usually formed in large masses and the detached cells may develop directly into a new mycelium. In the course of six weeks or so, when a pseudoparenchymatous tissue has been built up, the terminal cell or cells of the short, undifferentiated hyphae arising here and there from this tissue become thick-walled and develop protuberances. When only one apical cell is involved the structure somewhat resembles a spiked club, but occasionally four or five of the uppermost hyphal cells develop in the same characteristic manner. Only after a long resting period did a few of these gemmae germinate, and their significance in the life-history of the fungus is probably negligible, though from a taxonomic and morphological angle their existence is of considerable interest.

NIETHAMMER (ANNELIESE). **Weitere Beiträge über Verbreitung und Leben mikroskopischer Bodenpilze.** [Further contributions regarding the distribution and biology of microscopic soil fungi.]—*Arch. Mikrobiol.*, xii, 3, pp. 312–328, 4 figs., 1941.

Continuing her studies at the German Technical College, Prague, on the distribution and biology of soil fungi [*R.A.M.*, xvi, p. 557; xix, p. 675, and next abstract], the writer enumerates the species isolated from various types of waste and cultivated ground (namely, waste land, pastures, woods or forests, arable) in north-eastern Styria, together with some samples from Saxony and Czechoslovakia, and gives notes on the morphological and cultural characters of the more important, including *Mucor hiemalis*, *M. silvaticum*, *Zygorrhynchus moelleri*, *Penicillium notatum*, *P. suaveolens*, *P. expansum*, *P. luteum*, *Botrytis cinerea*, *Dematium* [*Pullularia*] *pullulans*, *Cladosporium herbarum*, *Fusarium dimerum*,

F. orthoceras, *F. bulbigenum*, *F. solani* and its var. *martii*, and *Arthrobotrys arthrobotryoides* (for which the soil is stated to be a new habitat).

NIETHAMMER (ANNELIESE). **Weitere Beiträge über mikroskopische Bodenpilze.** [Further contributions regarding the microscopic soil fungi.]—*Arch. Mikrobiol.*, xiii, 1, pp. 60–73, 1941.

In this paper, describing the writer's analyses of soil samples from a limited area of the western Sudetenland, Czechoslovakia [cf. preceding abstract], attention may be drawn to the following points. In culture experiments the microflora was more abundant and of greater variety at a temperature of 20° to 23° than at 32° to 34° C. Janke's observations (*Arch. Mikrobiol.*, v, p. 338, 1938) as to the association of certain bacteria with the soil fungi were confirmed. Many of the fungi from moorland soils, in which cellulose-fermenting bacteria are absent, flourished on cellulose, including the almost ubiquitous *Trichoderma koningi* [*T. viride*], *Fusarium oxysporum*, *F. orthoceras*, *F. dimerum*, *F. merismoides* var. *chlamydosporum*, and *F. equiseti*.

WALLACE (T.). **The diagnosis of mineral deficiencies in plants. A colour atlas and guide.**—vi+116 pp., 114 col. pl., 1 diag., London, H.M. Stationery Office, 1943. 10*s*. net.

This useful publication has been written primarily for technical officers and advisers concerned with crop production, but will also prove helpful to progressive growers and gardeners. The five chapters into which the text is divided deal with the essential points of plant nutrition, soils in relation to the supply of mineral nutrients, methods of determining deficiencies in crops, visual symptoms of such deficiencies, and the use of the visual method of diagnosis in the field. The symptoms of the deficiencies in the different crops are described and tabulated, and the effects of such complicating factors as weather, soil conditions, pests and diseases, mineral toxins, and mechanical injuries are discussed. A salient point of the author's method is the use of indicator plants, in which the special symptoms shown for each deficiency are unlike those for other deficiencies, and very pronounced. The plants selected (which are tabulated, with brief descriptions of the special symptoms) are also highly susceptible to the various deficiencies. The coloured plates arranged in four groups are a feature of the work.

KEYWORTH (W. G.). **A Phytophthora disease of the Hop in Great Britain.**—*Gdnrs' Chron.*, Ser. 3, cxiii, 2946, p. 238, 1943.

In September, 1942, a disease of Brewer's Gold hops resembling the black root rot (*Phytophthora cactorum*), previously reported from New Zealand [*R.A.M.*, xviii, p. 38] but new to Great Britain, was observed on two Kentish farms and one in Sussex. The diseased plants (87 out of 1,000 on one farm and 30 or 40 on another) occurred in groups, infection apparently spreading from one or more foci. One of the most conspicuous features of the root rot, as it appears in south-eastern England, is a dark brown discoloration of the vascular tissues of the roots, stock, and bine bases, which was not mentioned in connexion with the New Zealand outbreak, but in view of other similarities in the symptoms, including decay of the cortical tissues and wilting and death of the bines, the etiology of the two forms of the trouble is believed to be identical. Preliminary inoculation experiments with the isolated fungus, which resembles *P. cactorum*, on hop cuttings gave positive results, the typical brown discoloration of the wood developing at the basal ends, from which reisolation was also effected.

MAGIE (R. O.). **The epidemiology and control of downy mildew on Hops.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* 267, 48 pp., 3 figs., 8 graphs, 1942.

Since it was first recorded in New York in 1928 [*R.A.M.*, viii, p. 634], downy

mildew (*Pseudoperonospora humuli*) has become the most destructive disease of hops in the State, and its economic control is now a prerequisite for successful hop cultivation. The problems of its epidemiology and control vary greatly under seasonal and regional conditions. In this paper the results of studies conducted at Geneva and Waterville from 1937 to 1941 are described, some of which have already been noticed from other sources [ibid., xviii, p. 236; xix, p. 200; xx, p. 246; xxi, p. 245].

Sporangia of *P. humuli* held at 24°, 20°, 15°, and 10° C. suspended in water began to germinate after 1, $1\frac{1}{4}$, $1\frac{1}{2}$, and 2 hours, respectively, and completed the liberation of swarm spores in $1\frac{1}{2}$, 2, $2\frac{1}{2}$, and 4 hours, respectively. The optimum temperature for germination was between 15° and 20°, with a minimum at 5° and a maximum at 28°. Oospores germinated at temperatures between 5° and 20° after wetting periods of 4 to 16 days. Zoospores began to germinate in $2\frac{1}{2}$ to $3\frac{1}{2}$ hours at 15° to 24°, or 1 hour earlier when pieces of hop leaves were added to the suspension. Germination of the zoospores succeeded best in concentrated suspensions and in suspensions to which calcium citrate or a hop leaf was added; it was erratic and sparse in distilled water. Under conditions of laboratory and greenhouse temperature (18° to 24° and 20° to 35°), humidity, and light, about 10 per cent. of the sporangia survived nine days' drying on cut hop leaves and practically all were dead after 16, while at 5° and 10° in dark refrigerators some were still viable after 40 days. When separated from the host plant, on the other hand, the sporangia lived only a few hours. The time required for germination was found to increase with age, the older sporangia needing 3 to 4 hours of wetting at an optimum temperature. In the field 4 per cent. of the sporangia survived a severe drought for about one month. Zoospores in diluted suspensions prepared by atomizing the leaf with a minimum amount of distilled water remained motile only for a few hours at 10° to 20°, few of them germinating, but when a living leaf was added to similar suspensions, they were still active after five days at 10° and two days at 20°, and many germinated. In suspensions prepared by soaking the leaves in distilled water for 15 minutes, zoospores survived for one day at 10° and for several hours at 20°. Oospores germinated only after a dormant period of several months and survived $2\frac{1}{2}$ years of dry storage at laboratory temperature or at −18°.

In infection experiments with sporangia the shortest periods necessary for infection of potted plants at 24°, 18°, 13°, and 10° were $1\frac{1}{2}$, 2, 4, and 6 hours, respectively, the heaviest infection occurring on plants incubated for 24 hours at 13° and 18°. Maximum infection was produced by placing fresh sporangial suspensions directly on the leaf, while only about half as many lesions developed when the same suspensions were held over till zoospores had been produced. Sunlight proved very destructive to sporangia on inoculated plants, few lesions developing after 12 hours' exposure and none after 24. Old leaves were more resistant than young ones, and leaves of plants kept at 24·5° grew progressively more resistant than those at 18°.

The development of epidemics of downy mildew is outlined as follows. The oospores of the fungus overwintering in the soil cause the primary infection of young shoots. This results in the formation of basal spikes, which initiate the production of secondary inoculum (sporangia) within two to three weeks after the beginning of new growth of the host. Sporangia are produced throughout the entire growing season whenever the relative humidity is high at night. They are carried by wind from the basal spikes and lesions on the lower leaves to the upper part of the plant, and later, by rain, from the upper part downwards. The limiting factor in the development of epidemics is the frequency of suitable infection periods between late May and mid-August.

The following recommendations on control are given in the light of experiments carried out during 1936 to 1941. Sanitary practices, especially important in low-

lying sites, should consist mainly in the elimination of basal spikes before they sporulate and in frequent pulling of extra growth ('suckers') at the bases of the plants. New plantings should be made in fields with enough air drainage to dry the plants quickly after rains or dews. In established plantings adjacent hedgerows and trees should be removed, escaped hops should be destroyed within a mile, the vines stripped for the first few feet, and fewer vines trained. An effective spraying programme for most hop yards in the State would consist of four bi-weekly applications of Bordeaux 6–4–100 or yellow cuprocide 1½–100, beginning early in June. When epidemic outbreaks require immediate attention, dusting with copper-lime, 25–75, or cuprocide-sulphur, 7–93, proved useful in addition to spraying. Home-made Bordeaux was found to protect new growth between sprays better than did other copper or zinc materials tested. Bordeaux injury to young plant tissues and stunting of cones were observed only when the spray was applied through guns at the rate of about 400 gals. per acre, but not when applied through fixed nozzles at a lower rate. Leaf injury by Bordeaux and zinc oxide was reduced by adding ¼ per cent. of cottonseed oil to the sprays. The results of comparative resistance tests showed that several varieties were fairly resistant to cone and leaf infection as well as to basal spiking. Of these, Brewer's Gold is recommended as apparently of commercially good quality. On resistant varieties downy mildew can be controlled in most seasons with one application of Bordeaux given about seven days after the beginning of the blossoming or burr period.

HATTON (R. G.), BEARD (F. H.), & SALMON (E. S.). **New varieties of Hops.**—*J. Minist. Agric.*, l, 4, pp. 187–189, 1943.

Notes are given on five new hop varieties tested for some years at East Malling Research Station, and now being grown in commercial gardens, viz., Brewer's Favourite (somewhat susceptible to downy mildew [*Pseudoperonospora humuli*] but controllable by rigorous 'spiking' and spraying), Quality Hop, Bullion Hop (both not particularly susceptible), Fillpocket (resistant in the cones), and Brewer's Gold (not particularly susceptible to downy mildew but sometimes attacked by nettlehead).

CHONA (B. L.). **Red-rot of Sugarcane and its control.**—*Indian Fmg*, iv, 1, pp. 27–32, 7 figs., 1943.

This is a popular account of the severe epidemics of red rot of sugar-cane (*Colletotrichum falcatum*) [*R.A.M.*, xxii, p. 197] reported from various localities in the cane belt of the eastern United Provinces and northern Bihar during recent years. For the control of the disease growers are advised to carry out systematic roguing of diseased clumps throughout the season, to use only healthy seed, to adopt a long rotation, to treat the cuttings with fungicides prior to planting, to avoid planting in October when there is abundant inoculum present, and to introduce seed plots for growing healthy seed. It is suggested that eventually a co-ordinated scheme of seed nurseries should be instituted. At present a nucleus of this plan is being organized by the Sugar-Cane Specialist, Bihar, with the co-operation of progressive growers and sugar factory-owners.

GÄUMANN (E.). **Über die Entwicklung und die Wirtswahl einiger schweizerischer Rostpilze.** [On the development and choice of host of some Swiss rust fungi.]—*Ber. schweiz. bot. Ges.*, liii A, pp. 465–479, 5 graphs, 1943.

Three new species of *Puccinia* are described and some additional information concerning *Melampsora larici-epitea* is presented in this paper. In the autumn of 1939 the author collected teleutospores of the rust on *Salix retusa* (*M. larici-epitea* f. sp. *larici-retusae*), which in the following spring were transferred to larch, the uredospores thus obtained being used for cross-inoculations on 15 *S.* spp., of which

nine proved to be more or less susceptible, viz., *S. alpicola, S. foetida, S. hastata, S. helvetica, S. nigricans, S. waldsteiniana* (all new hosts for the f. sp. *larici-retusae*), *S. herbacea, S. retusa*, and *S. serpyllifolia*; one slightly so (*S. reticulata*); and the remaining five, namely, *S. alba, S. caesia, S. caprea, S. purpurea*, and *S. repens*, immune. *S. hastata* and *S. nigricans* are collective hosts, the former for f. sp. *larici-reticulatae* and the latter for f. sp. *larici-purpureae*.

GREENE (H. C.). **Notes on Wisconsin parasitic fungi. II.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxiv, pp. 83–98, 1942.

Continuing his earlier paper [*R.A.M.*, xxi, p. 100], the author gives brief descriptive notes on parasitic fungi collected chiefly in the southern parts of Wisconsin in 1940 and 1941. A section is devoted to additional hosts of fungi previously recorded on others. The records include *Microsphaera alni* var. *extensa* on red oak (*Quercus rubra*) [ibid., xix, p. 364], *Cercospora variicolor* on cultivated *Paeonia albiflora, C. carotae* on carrot, and *Sporonema trifolii* n.sp. on leaves of red clover (*Trifolium pratense*). *S. trifolii* is characterized by amphigenous, often somewhat flattened pycnidia borne on elongate, brown or blackish-brown spots, and hyaline, cylindric, straight or slightly curved, very variable conidia measuring 4 to 9 by 1·3 to 3 (mostly 5·5 to 7·5 by 1·5 to 2·5) μ.

DA CAMARA (E. DE S.) & DA LUZ (C. G.). **Mycetes aliquot Lusitaniae V.** [Some fungi of Portugal V.]—*Agron. lusit.*, iii, 4, pp. 307–321, 16 figs., 1941.

The present instalment of the authors' critically annotated list of Portuguese fungi [*R.A.M.*, xxi, p. 504] comprises 28 species, of which six are new, including *Fusicoccum acaciae* on *Acacia, Macrophyllosticta* (*Phyllosticta*) *hydrangaecola* and *Ellisiella hydrangae* on *Hydrangea hortensis*, and *Melanconium jasmini* on jasmine.

SHEAR (C. L.). **Conserving names of fungi.**—*Mycologia*, xxxv, 3, pp. 267–271, 1943.

In these comments on some problems of nomenclature the author expresses the view that much time and effort are wasted in following too rigidly the law of priority in selecting and typifying generic names. It is pointed out that for most of the older genera no single author really defined the genus according to its present concept. Instead of stressing dates and priority the author advocates conserving generic names. He maintains that many of the names established by pre-Friesian authors should be recognized whether they have been adopted or approved by Fries or not. It is suggested that a major effort should be directed towards selecting types which will fix the names in accord with the best present usage.

NOLL (A.). **Über den Nachweis von Rostmyzel im Gewebe der Wirtspflanze.** [On the detection of rust mycelium in the tissue of the host plant.]—*Angew. Bot.*, xxv, 1–2, pp. 24–28, 1 fig., 1943.

Holz's cotton blue stain for the detection of the scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] mycelium in apple leaves [*R.A.M.*, xv, p. 661] was used with equal success for locating the hyphae of certain cereal rusts, bean rust (*Uromyces phaseoli*) [*U. appendiculatus*], and flax rust (*Melampsora lini*) in the host tissue.

DOBBS (C. G.). **A Mucorine parasite on Penicillia.**—*Nature, Lond.*, cl, 3802, p. 319, 1 fig., 1942.

A *Piptocephalis*, which does not correspond closely to any described species, but is nearest to *P. tieghemiana*, was found to grow parasitically on cultures of several unnamed species of *Penicillium*, as well as on *P. roqueforti, P. notatum, P. pfefferianum, P. glabrum*, and also on *Mucor mucedo*+ and —, *M. hiemalis*+ and —, and *Aspergillus niger*. The parasitism, when it occurs, is strongly marked and results in a conspicuous growth of white (ageing to buff) 'conidiophores'

above the host. This is believed to be the first report of a Mucorine parasite on moulds other than another member of the Mucorales. Susceptibility to the parasite might sometimes provide, it is suggested, a useful additional character for distinguishing species of *Penicillium*.

Clayton (E. E.), Smith (T. E.), Shaw (K. J.), Gaines (J. G.), Graham (T. W.), & Yeager (C. C.). **Fungicidal tests on blue mold (Peronospora tabacina) of Tobacco.**—*J. agric. Res.*, lxvi, 7, pp. 261–276, 4 figs., 1943.

In field and greenhouse tests with emulsified oil sprays against blue mould of tobacco (*Peronospora tabacina*) [*R.A.M.*, xxi, p. 505], it was found that oils containing appreciable amounts of linoleic, eleostearic, or licanic glycerides, such as soy-bean, linseed, cottonseed, tung, oiticica, and peanut oils, are strongly fungicidal, whereas those containing lauric, myristic, palmitic, chaulmoogric, oleic, and stearic glycerides, such as olive, castor, palm, coconut, chaulmoogra, beef tallow, pine, and paraffin oils, are of no fungicidal value. The tobacco leaves sprayed with a fungicidal oil showed numerous oil globules in the intercellular spaces, and such leaves were resistant to fungal attack.

Copper-oil sprays were generally more effective than oils alone, most successful being the cupric oxide-cottonseed oil mixture; copper oxide alone was almost entirely ineffective. Of the emulsifiers tested with copper-oil mixtures, only a few of the complex sulphonated alcohol type proved satisfactory.

In an attempt to find substitute materials for copper 122 organic compounds were tested. Of these the best results were obtained with benzyl salicylate with 1 per cent. oil, and bismuth salicylate without oil [ibid., xxii, p. 115]. Spore germination tests showed that (1) cuprous oxide inhibited the germination of spores at $\frac{1}{8}$ spray strength, (2) bismuth salicylate was only $\frac{1}{4}$ to $\frac{1}{16}$ as toxic as cuprous oxide, and (3) cottonseed oil was non-toxic at full spray strength. It is concluded, therefore, that fungicidal value cannot be measured in terms of ability to inhibit spore germination.

Valleau (W. D.), Johnson (E. M.), & Diachun (S.). **Tobacco diseases.**—*Bull. Ky agric. Exp. Sta.* 437, 60 pp., 34 figs., 1942.

This bulletin is a revised edition of *Bull.* 362, published in 1936 [*R.A.M.*, xvi, p. 213]. It is on the same lines as the earlier one, but devotes a separate section to tobacco disease control in general.

McLean (Ruth A.). **Observations on Cercospora leaf spot of Tobacco and the question of varietal resistance.**—*Phytopathology*, xxxiii, 5, pp. 354–362, 1 fig., 1 graph, 1943.

Flue-cured tobacco at Oxford, North Carolina, was attacked in the early part of the exceptionally hot and dry 1941 growing season by *Cercospora nicotianae*. The circular to angular, necrotic areas, 0·5 to 5 mm. in diameter, were more suggestive of the brown spot caused by *Alternaria longipes* than of the actual pathogen, the identity of which was, however, established when a protracted rainy spell in August induced abundant sporulation in a large percentage of the lesions. Several varieties, e.g., Adcock Pinkney Arthur, were almost free from spots for the tenth leaf from the top of the plant, whereas others, Gold Dollar for instance, were heavily infected. Evidence is adduced in favour of the hypothesis that the apparent differences in susceptibility were probably due to the earlier ripening of the lower leaves of one variety than of those of the other, rather than to any specific divergence in reaction to the pathogen. In all varieties the upper five leaves were definitely spotted, but markedly less so than the lower ones, the counts being progressively higher the lower the position of the leaf on the stalk.

FOSTER (H. H.). **Resistance in the genus Nicotiana to Phytophthora parasitica Dastur var. nicotianae Tucker.**—*Phytopathology*, xxxiii, 5, pp. 403–404, 1943.

None of the 13 species of *Nicotiana* tested in the greenhouse at the Tobacco Institute of Puerto Rico, Rio Piedras, for their reactions to black shank (*Phytophthora parasitica* var. *nicotianae*) proved to be immune under the exacting conditions of the soil inoculation experiments, but some degree of resistance was shown by plants of transplanting age only of two varieties of *N. tabacum*, Florida Rg and Tobacco Institute 150 (53–A). Two commercial varieties, Virginia No. 9 and Utuado X No. 1, susceptible in the greenhouse, gave some evidence of resistance in the field. Three other species, *N. repanda*, *N. rustica*, and *N. longiflora*, were definitely resistant to the disease. In the first-named, resistance appeared to be located primarily in the roots, the active infection present in the aerial organs being 'corked off' on arrival at the transition zone between stem and roots, and the new stem and leaf growth showing no symptoms. *N. repanda*, previously reported to be resistant to other important tobacco diseases [*R.A.M.*, xix, p. 307], may prove of value in interspecific crossing with *N. tabacum*, but F_1 plants failed to initiate new growth after transplanting.

JENKINS (ANNA E.) & GRODSINSKY (L.). **Sphaceloma on Willow in New Zealand.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 1–3, 1 fig., 1943.

The fungus causing a disease of crack willows (*Salix fragilis*) and, less frequently, weeping willows (*S. babylonica*) in New Zealand, reported in 1926 by Murray under the name of *Gloeosporium capreae* [*R.A.M.*, v, p. 707], is here interpreted, on the basis of Murray's description, as a species of *Sphaceloma* and named *S. murrayae* n.sp. It is believed to be the first record of any species of this genus on *Salix*.

GRAVES (A. H.). **Chestnut breeding work in 1942.**—*Rep. Brooklyn bot. Gdn, 1942* (*Brooklyn bot. Gdn Rec.*, xxxii, 2), pp. 78–80, 1943.

Further details are given of chestnut breeding for resistance to *Endothia* [*parasitica*: *R.A.M.*, xxii, p. 185] at Brooklyn Botanic Garden, New York.

MILLER (P. W.). **Current investigations on Walnut blight and recommendations for its control in war-time.**—*Rep. Ore. St. hort. Soc., 1942*, pp. 142–146, [? 1943].

In further work on the control of walnut blight [*Xanthomonas juglandis*: *R.A.M.*, xxi, p. 310] in Oregon during 1942, when infection was extremely severe in most parts of the Pacific North-west, two applications of yellow cuprous oxide at the rate of 1½ lb. in 100 gals. water, plus 1 pint ortho adhesive, given in the middle pre-bloom and early post-bloom stages, reduced infection on the nuts from 48·6 to 8·4 per cent., 1 lb. in 100 gals. plus 1 qt. ortho adhesive, reducing it to 8·7 per cent. The same number of applications of Bordeaux mixture (4–2–100) plus a heavy oil emulsion (1 pint) reduced it to 7·2 per cent. Occasionally slight foliar russeting followed the use of yellow cuprous oxide, alone or in combination with ortho adhesive, but no such effect resulted when an alkyd resin spreader-sticker (emulsifier B 1956 spreader) was added at the rate of ¼ pint per 100 gals.

A dust consisting of 25 per cent. monohydrated copper sulphate, 55·75 per cent. 300-mesh hydrated lime, 10 per cent. frianite, 9 per cent. dusting sulphur, and 0·25 per cent. orvus [ibid., xxii, p. 163] flakes appeared to be more effective than a 10 per cent. yellow cuprous oxide dust. Two applications of the former in the early pre-bloom and late pre-bloom stages reduced infection on the nuts from 69·6 to 7·3 per cent., while the latter gave 22 per cent. infection; three thorough applications (including an early post-bloom spray of the yellow cuprous oxide), however, reduced infection on the nuts from 51·3 to 7·7 per cent.

In view of the present need to economize in copper, Bordeaux mixture (4–2–100)

is advised for general use. If yellow cuprous oxide is substituted it should be employed at the rate of 1 lb. per 100 gals. water, to which should be added $\frac{1}{4}$ pint emulsifier B 1956 spreader. Two spray treatments should be given, in the middle to late pre-bloom and early post-bloom stages: if only one can be made, the latter should be omitted. If dusting has to be resorted to, a monohydrated copper sulphate dust of the type mentioned above, in which talc may replace frianite, is tentatively recommended. If monohydrated copper sulphate is unavailable, a dust containing 10 per cent. yellow cuprous oxide, 67 per cent. talc or frianite, 10 per cent. diatomaceous earth, and 15 per cent. dusting sulphur may be used. Two applications should be given in the middle to late pre-bloom and early post-bloom stages. For maximum efficiency the spray equipment should operate at a pressure of 500 to 600 lb. per sq. in. A very efficient type of spray gun is the 'bloom' or 'fog-drive' gun, consisting of three or more spray nozzles mounted abreast on a crossbar fastened to an aluminium barrel with the cut-off in the basal casting. The addition of 1 oz. sugar (dissolved in water) to each 100 gals. Bordeaux mixture will preserve it for several days.

JENKINS (ANNA E.). **Leaf spot on Terminalia arjuna.**—*Phytopathology*, xxxiii, 5, pp. 404–405, 1 fig., 1943.

Since 1937 *Terminalia arjuna* in the United States Plant Introduction Garden, Coconut Grove, Dade County, Florida, has been affected by a hitherto unreported disease characterized by the development on the leaf blades of circular to irregular spots, sometimes delimited by the veins, 2 to 8 mm. or upwards in diameter, wood-brown, light brownish-drab, or pale drab-grey above and mikado-brown to tawny-olive below, becoming desiccated, shrunken, and partly or entirely falling away from the rest of the leaf. Severely infected leaves which have shed much of their tissue acquire a very ragged or insect-eaten appearance. The trouble seems to be of fungal origin, the lesions bearing pycnidia of the *Phyllosticta* type and yielding on isolation a species of *Phomopsis* and *Pestalotia disseminata*.

SLAGG (C. M.) & WRIGHT (E.). **Diplodia blight in coniferous seedlings.**—*Phytopathology*, xxxiii, 5, pp. 390–393, 1943.

First-year pine (*Pinus nigra*, *P. edulis*, and *P. ponderosa*) and Douglas fir (*Pseudotsuga taxifolia*) seedlings in a Government nursery at Manhattan, Kansas, were severely blighted by *Diplodia pinea*, which was also found on the needles, needle bases, bark, and cone scales of 'die-back' branches of mature trees of *Pinus nigra*, *P. ponderosa*, *P. pungens*, *P. rigida*, and *P. sylvestris* at the State College in the same town. Uninjured seedlings of *P. nigra* were killed in 30 days by mycelial inoculations with a monospore culture of the pathogen from the same host, typical pycnidia being formed on the dead needles 15 days after infection.

Septation of the pycnospores of *D. pinea* varied widely on different hosts and on the various parts of the plants. The septate spores were darker, and wider in proportion to their length, than the non-septate, 100 of the latter averaging 35·3 by 13 μ as compared with 32·1 by 14·65 μ for the same number of the former. About 25 per cent. of all the pycnospores observed were septate, the highest number occurring on the cone scales of the twig branches, and the fewest on the long central needle.

BINGHAM (R. T.) & EHRLICH (J.). **A Dasyscypha following Cronartium ribicola on Pinus monticola. I. II.**—*Mycologia*, xxxv, 1, pp. 95–111; 3, pp. 294–311, 4 figs., 1943.

Amended descriptions are given of *Dasyscypha calyciformis* (on the basis of an authentic Rehm exsiccatus and four other dry specimens), and of *D. agassizii* (based on 30 specimens including a slide of the isotype). A small-spored, white-

excipled species of the same genus frequently associated with blister rust (*Cronartium ribicola*) cankers on *Pinus monticola* in the north-western United States, is stated to have often been confused in the past with the above-mentioned two species [*R.A.M.*, xxii, p. 46]. A comparative study of the three fungi showed, however, that it can be distinguished from them on the basis of the following characters. The fungus from *P. monticola* has unswollen paraphyses, round-topped ascus membranes, apothecia with relatively short stipes and narrow disks, and an abundant and conspicuous imperfect stage with subulate phialides and readily germinating conidia; *D. agassizii*, on the other hand, has swollen paraphyses, flat-topped ascus membranes, apothecia with relatively long stipes and broad discs, and an infrequent and inconspicuous imperfect stage with moniliform or slightly subulate phialides; while *D. calyciformis* has an infrequent and inconspicuous imperfect stage with conidia that germinate only with difficulty. The three species, all saprophytic or weakly parasitic, also differ in their host range and geographical distribution: the fungus on *P. monticola* seems to be restricted to this host and was found only in the north-western United States and British Columbia; *D. calyciformis* occurs mainly on *Abies*, but also on *Pinus*, *Larix*, and *Picea* in Europe; and *D. agassizii* is known, in addition to these four genera (chiefly on *Abies*), on *Tsuga* in north-eastern North America. Ascus and ascospore measurements showed that the fungus from *P. monticola* has shorter asci than *D. calyciformis*, and smaller ascospores than *D. agassizii*. It is concluded that the fungus on *P. monticola* is distinct from the other two species under consideration, but as it was not possible to compare large numbers of collections of the three fungi on various hosts, it is not proposed as a new species.

Finlay (R. H.). **The preservation of timber, with special reference to Rhodesia.**—*Proc. Rhod. sci. Ass.*, xxxix, pp. 103–112, 1942.

The early history and modern developments of timber preservation are briefly traced and some particulars given of the application of various processes under Rhodesian conditions. Dowicide P (sodium tetrachlorophenolate and sodium 2-chloro-ortho-phenylphenolate) [*R.A.M.*, xix, p. 574] is used by the Forestry Department and at sawmills for the control of blue stain (*Ceratostomella* spp.), the Rand Mixture by the Globe and Phoenix Mine, and creosote at the Forest Reserve plant at Mtao for the treatment of *Eucalyptus* wood.

Ballman (D. K.) & Smith (F. B.). **Fungicides and germicides in the pulp and paper industry.**—*Paper Ind.*, xxv, 2, pp. 143–148, 8 figs., 1943.

The immersion of pulp logs in 1 per cent. solutions of dowicide G or S has been found not only to eliminate sap stain due to *Ceratostomella pilifera*, *C. ips*, *C. pluriannulata*, *Endoconidiophora coerulescens*, *E. moniliformis*, *Graphium rigidum*, *Diplodia* sp., and *D. natalensis* [*R.A.M.*, xxi, p. 175 *et passim*], but also to decrease the loss of cellulose resulting from infection by the 'dry-rot' group of organisms, comprising *Lenzites trabea*, *L. sepiaria*, *Poria incrassata*, *Merulius* [including *M. lacrymans*], *Fomes annosus*, *F. roseus*, *Stereum sanguinolentum*, *Polystictus abietinus*, and *Trametes pini*.

The treatment of lap stock is best performed at the wet press, where a solution of dowicide F (sodium 2-, 4-, 5-, 6-tetrachlorophenate) [ibid., xx, p. 465] is sprayed on the sheet. By reason of its very low water solubility and vapour pressure, this phenol is capable of inhibiting mould growth throughout the layers of the stock. Dowicide G (sodium pentachlorophenate) [ibid., xx, pp. 465, 587] is not quite such an effective fungicide, but where freedom from residual chemical odour is a consideration it may be substituted for F at a slightly stronger concentration. The souring of pulp in the system during shut-down periods is a sequel to the

action of bacteria and moulds, which may usually be obviated by the addition of 2 lb. dowicide G per ton of pulp. This precaution is particularly necessary in the case of coloured stocks, in which changes of shade may be caused by alterations in the hydrogen-ion concentration of the system through microbiological invasion. The same preparation may also be usefully employed in the washing of felts during shut-downs at the rate of 2 to 4 lb. per 50 gals. water, the solution being thrown on at the entering side of the press in such a way that a pool of liquid forms behind the press and both felts become thoroughly saturated. By this means an increase in the life of wet felts of 10 to 15 (or up to between 40 and 60) per cent. may be effected, the corresponding extension for top or pick-up felts being from 10 to 100 per cent. Some manufacturers of heavy board from waste stock add dowicide to the system continuously at a concentration of 50 parts per million, thereby prolonging the life of the felts by 50 to 200 per cent.

Absolute commercial control of the slime-forming moulds, *Aspergillus niger*, *Penicillium puberulum*, *Chaetomium globosum*, and *Mucor racemosus* has been secured by the introduction into the system of dowicides A, B, and C (sodium ortho-phenylphenate, sodium 2-, 4-, 5-trichlorophenate, and sodium 2-chloro-ortho-phenylphenate, respectively), as well as by F and G, at concentrations of 0·02, 0·03, 0·04, and 0·2 per cent., while B was also completely mycostatic at 0·004 to 0·009 and F at the last-named strength.

The addition of dowicide G (2 per cent. by weight) to the starch adhesive used for the pasting of corrugated stock boards to the outer ply secures a mould-resistant surface, and the same product is now in commercial use for the treatment of egg case fillers and flats [ibid., xx, p. 465]. Either A or G may be applied to the inner wraps of soap, while the oil-soluble dowicide 1 (ortho-phenylphenol), dissolved in the wax used for coating the outer wraps, exerts a fungistatic and fungicidal action on mould growth below the wax film. The same preparation protects gummed tape from spoilage by moulds, while G has been shown by field tests in Louisiana and Florida to confer on insulation board and building papers immunity from termites and fungal decay, for which purpose a concentration of 0·6 to 0·75 per cent. of the dry weight of the board should be retained.

Seliskar (C. E.). **Decay in Douglas Fir cork and studies in the cultural identification of fungi causing decay in Western Hemlock and Douglas Fir.**—*For. Cl. Quart.*, xvi, 1, pp. 4–11, 1942–3. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 6, pp. 780–781, 1943.]

Four fungi, viz., *Mortierella simplex*, *Dematium* sp., (?) *Chalara* sp., and an unidentified Basidiomycete, were consistently isolated from small, hollow areas scattered through Douglas fir [*Pseudotsuga taxifolia*] bark, a prolific source of high-grade cork. The decay might be mistaken for insect injury but circumstantial evidence indicates that it is due to fungus infection. Only the Basidiomycete, however, appeared to be definitely implicated. Further observations are made on the cultural identification of the wood-rotting fungi of western hemlock [*Tsuga heterophylla*] and Douglas fir, including the general plan of the studies and some of the problems to be solved.

Recognition of decay and insect damage in timbers for aircraft and other purposes.—18+iii pp., 12 figs., London, H.M. Stationery Office, 1943. 6*d*.

In this booklet, prepared by the Forest Products Research Laboratory, Princes Risborough, descriptions are given of the defects and blemishes most commonly found in the timbers generally used in aeroplane manufacture. Part I shows how 'dote' may be distinguished from other forms of discoloration, deals with defects caused by insects, and describes defects (including those produced by fungi)

characteristic of individual woods. In part II a list is given of timbers in general use, with notes on their resistance to decay and insect injury.

'Dote' is the popular name applied to the early stages of decay resulting from infection of the standing tree by heart-rotting fungi or of felled timber, either in the log or after conversion, during seasoning. In Sitka spruce (*Picea sitchensis*) and Douglas fir (*Pseudotsuga douglasii*) it is usually caused by *Trametes serialis* [*R.A.M.*, xxii, p. 187]. 'Dote' must not be confused with sap stain (blue stain) which frequently occurs together with incipient decay. Once timber has been well seasoned, further spread of sap stain is unlikely to occur, even if the timber is re-wetted.

Brown streaks due to incipient decay are sometimes confused with streaks caused by local accumulations of resin in the fibres. These resin or pitch streaks occur in softwoods, and generally extend much farther along the grain than across it, fading away gradually. They do not affect the strength of the wood.

No timber in which there is any sign of 'dote' can be accepted for air-frame construction, but if the 'dote' is only superficial, perfectly sound timber can sometimes be obtained by planing down the affected part. Similarly, if infection has entered at the end, it can be cut away. Affected timber containing a living fungus can be sterilized by exposure of 4 to 8 hours (depending on the thickness) to a temperature of 65° C. in a kiln in which a high atmospheric humidity is maintained. In general, kiln-dried timber can be considered as free from living fungal infection. There is no risk of dote spreading in a pile of seasoned timber in which the moisture content is well under 20 per cent. of its oven-dry weight.

Minor defects sometimes mistaken for 'dote' include pith flecks, scars due to bird pecks or other slight injuries to the standing tree, and the dark brown, black, or greenish streaks known as mineral streaks [cf. ibid., xxii, p. 184]. The increasing use of lamination reduces the influence of minor defects or slight traces of 'dote' upon the strength of the member as a whole, so that a more rigid standard of inspection is required when dealing with timber to be used in the solid than is necessary when it is to be laminated.

A table is given showing the general distinctions (distribution, colour, effect, and shape) between sap stain, incipient decay, and natural discoloration.

TUCKER (C. M.). **Controlling plant diseases in the home garden.**—*Circ. Mo. agric. Exp. Sta.* 238, 8 pp., 1942.

This pamphlet gives full direction for the avoidance or control of some destructive kitchen-garden plant diseases by rotation, sanitation, seed treatment, cultural practices, and the selection of resistant varieties. In connexion with the last-named factor the following points of interest may be mentioned. The Michigan and Florida Golden self-blanching varieties of celery are highly resistant to yellows while among the green sorts Paragon, Earligreen, and Sweetheart are specially recommended, but the crop is not well adapted to Missouri conditions as a whole. Resistance to pink rot [*Phoma terrestris*] and yellow dwarf is a characteristic of the Sweet Spanish onion. Some excellent maize varieties resistant to bacterial wilt [*Xanthomonas stewarti*] have been developed, including Golden Cross Bantam, Marcross, Spancross, and Whipcross.

Southern Rhodesia. Act to make better provision for the prevention of the introduction into and spread within the Colony of pests and diseases destructive to plants, and for other matters incidental thereto.—12 pp., 1942.

This Act, to be cited as the Plant Protection Act, 1942, defines the provisions laid down for the eradication and prevention of the spread of plant diseases and pests, the powers of the Governor in relation to the importation of plants into the Colony of Southern Rhodesia, the specific regulations applicable to cured tobacco, the duties of inspectors and owners of land, and other measures concerned with the

protection of plants from injurious agents [see next abstract]. The Importation o Plants Regulation Act and other laws are repealed [*R.A.M.*, xii, pp. 399, 463].

Southern Rhodesia. Government Notices 184 to 187.—7 pp., 9th April, 1943.

Under the terms of the Plant Import Regulations, 1943, made under the Plant Protection Act, 1942 [see preceding abstract], the following restrictions apply, as from 9th April, 1943, to the introduction into Southern Rhodesia of certain classes of plant material from non-scheduled States (i.e., all countries except those comprised in the Plant Interchange Schedule, namely, the Union of South Africa, Northern Rhodesia, the Belgian Congo, and Nyasaland Protectorate). The importation is prohibited of elm seeds and plants (including all species of *Ulmus*) from the continent of Europe or from any country known to harbour the disease *Ceratostomella ulmi*, and of chestnut (*Castanea*) seeds and plants from North America or any other known habitat of *Endothia parasitica*. All consignments of tea plants or seed must be accompanied by a certificate from a recognized institution in the country of origin guaranteeing the absence, within a radius of ten miles from the place of production, of blister blight (*Exobasidium vexans*). Similar guarantees are required in the case of citrus trees, budwood, and seeds in respect, *inter alia*, of freedom from canker (*Pseudomonas citri*) at a date not more than three months prior to the dispatch of the consignment, and further vouching for the non-occurrence of the disease at any time within a distance of 100 miles from the nursery or plantation of origin, except that for this purpose Portuguese East Africa [*R.A.M.*, xiii, p. 544] ranks as a member of the Plant Interchange Schedule and is therefore exempt from the provisions; of tobacco seed and unmanufactured leaf (including commercial samples) from countries in which blue mould or downy mildew (*Peronospora* spp.) [*P. tabacina*] is known to occur; of growing plants and suckers of bananas (the importation of leaves severed from the plant is categorically prohibited), the maximum number of which permitted to enter the Colony shall be twelve, each consignment to be accompanied by a guarantee of the absence of Panama disease (*Fusarium* [*oxysporum* var.] *cubense*) and leaf spot (*Cercospora*) [*musae*] from the locality of cultivation; of tomato seed from Italy, Germany, North America, or any other country known to harbour bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*); of maize and barley seed, consignments of which must not exceed 10 lb. in weight, and must be accompanied by a duly authenticated statement as to the freedom of the place of origin from *Sclerospora* spp. and *A.* [*Xanthomonas*] *stewarti*; and of pome fruits (including ornamentals of the genera *Cydonia*, *Malus*, and *Pyrus*) in respect of fireblight (*Bacillus amylovorus*) [*Erwinia amylovora*].

Under Government Notices 185 (dealing with nurseries) and 187, tobacco leaf curl, rosette, and 'kromnek' are declared pests and measures for their control specified.

Service and regulatory announcements. List of intercepted plant pests, 1942.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 41 pp., 1943.

Among the pathogens intercepted on plant material arriving in United States territory during the period from 1st July, 1941, to 30th June, 1942 [*R.A.M.*, xxii, p. 176] may be mentioned *Ascochyta imperfecta* on lucerne from New Zealand, *Cercospora musae* on banana from the American Virgin Islands, Cuba, Dominican Republic, Honduras, and Panama, *Chlamydomyces palmarum* on banana from Panama, *Claviceps paspali* on *Paspalum notatum* from Mexico, *P. dilatatum* from Costa Rica, and *P.* sp. from Cuba, *Cordana* [*Scolecotrichum*] *musae* on banana from Panama, *Cronartium conigenum* on *Pinus chihuahuana* from Mexico, *Diaporthe batatatis* on sweet potato from Brazil and Chile, *Helminthosporium torulosum* on plantain from Cuba, *Penicillium gladioli* on *Watsonia* sp. from South Africa, *Phoma mali* on apple from Mexico, and *Physalospora obtusa* on apple from Australia.

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SCHULZE (B.). **Mykologische Prüfung der Tropeneignung organischer Werkstoffe, insbesondere von Holz.** [The mycological testing of organic manufacturing materials, especially wood, for adaptability to the tropics.]—*Holz Roh- u. Werkstoff*, v, 10, pp. 345–350, 1 fig., 1 graph, 1942.

The following technique is recommended for testing the resistance of wood and other materials to fungal decay in hot countries [cf. *R.A.M.*, xv, p. 333 *et passim*]. The wood samples, 5 by 2·5 by 1·5 cm. for Kolle flasks and 10 by 10 cm. for Petri dishes, are exposed for a period of four months to infection by pure cultures on malt agar of wood-destroying fungi, of which *Polystictus versicolor*, *Poria contigua*, and *Coniophora cerebella* [*C. puteana*] are the most suitable for hardwood tests and *Lenzites trabea*, *P. contigua*, *C. puteana*, and *Lentinus lepideus* for softwoods. The culture dishes are maintained in an atmosphere of 80 per cent. relative humidity and at a temperature of 28° C. The criteria used for the estimation of intensity of infection are loss of weight, evident disorganization, and (in particular cases) changes in specific properties of the sample, e.g., loss of strength. Each experiment is repeated at least twice, the weights of the samples being determined after drying at 105°. The wood blocks are sterilized by steam for 30 minutes before insertion in the flasks, one being laid directly on the mycelium and a second on an interposed glass bench, while a control block of a hard or softwood, according to the nature of the test, is also introduced into the culture. For materials such as paper, cardboard, and similar cellulose-containing fibrous products, *Lenzites trabea*, *P. contigua*, and *C. puteana* are used as inoculum, and the samples are dried at 20° with relative humidity of 65 per cent. Data obtained in the application of the method are given.

GREEN (D. E.). **Diseases of vegetables.**—vii+208 pp., 92 figs., London, Macmillan & Co. Ltd., 1943. 8*s*. 6*d*.

This manual is a revised and amplified version of the author's monthly articles in the Royal Horticultural Society's *Journal* [*R.A.M.*, xxi, p. 316], and is intended primarily for the small gardener. Technical terms have therefore been as far as possible omitted, though the scientific names of the pathogens are given, and attention is directed in the first instance to conspicuous symptoms facilitating the recognition of the diseases, which is further assisted by a useful key. Control measures are discussed in the fullest manner practicable.

HILDEBRAND (A. A.) & KOCH (L. W.). **Studies on blackroot of Sugar Beet seedlings.** —*Sci. Agric.*, xxiii, 9, pp. 557–567, 1 fig., 1943.

Serious reduction in stands of sugar beet seedlings is caused almost every year in Ontario by black root [*R.A.M.*, xix, p. 637; xxi, p. 60]. In greenhouse experiments conducted since 1941 with seed of a standard size (16/64 to 14/64 in.) planted in black-root infected Brookston clay loam soil in flats it was found that, at temperatures from 17° to 19° C., the greatest germination usually took place from the sixth to the ninth day after planting, inclusive. Disease symptoms

first appeared on the seventh or eighth day, and mortality of seedlings was greatest from the ninth to the thirteenth day. Seedlings which became infected after this initial period of high mortality, survived in a relatively high proportion and showed remarkable power of recovery. In tests with a commercial fertilizer (2–16–10) applied to the soil in flats at the rate of 400 lb. per acre, half of which amount was placed in a band in contact with the seed, and the other half in a band 1½ in. below and a little to one side of the seed, disease incidence was significantly greater in soil that was cultivated than in one that was not, irrespective of fertilizer treatment. Germination was poorest in soil that was cultivated but untreated, and highest in cultivated soil to which fertilizer had been added. Black root was less prevalent in treated than in untreated infested soil, regardless of whether or not the soil was cultivated. Treatment of seed with ceresan and nomersan [ibid., xxii, p. 259] dusts afforded the seedlings a considerable measure of protection against the pre-emergence phase of damping-off, producing stands with 10 per cent. more healthy seedlings than in the case of no treatment, but failed to protect them sufficiently during the post-emergence phase to ensure profitable stands.

The most potentially important results from the practical standpoint were obtained with green manure in the form of cover crops. A germination percentage (expressing the total number of seedlings which appeared as a percentage of the number of seed clusters sown) of 207 followed the incorporation of maize into the soil, and one of 192 that of soy-bean, while untreated soil showed one of only 82 and steamed soil one of 234. Disease incidence after maize and after soy-bean was 7·6 and 10·4 per cent., respectively, as compared with 79·7 per cent. in untreated and 16·9 per cent. in steamed soil. The vigour of seedlings in soy-bean-treated soil was far superior to that in the other two series; the weight of 150 seedlings grown in the soy-bean-treated soil was almost three times that of similar numbers grown in either maize-treated or steamed soils. Diseased seedlings grown for two months in the greenhouse and then transplanted to an outdoor plot all recovered and gave a yield of only about 15 per cent. less than that from initially healthy seedlings.

Vižnevski (V. P.). **The quality of catalase in the Beetroot, and the resistance of Sugar Beet to Botrytis cinerea during storage.**—*Biohimija*, v, pp. 408–416, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 3, pp. 245–246, 1943.]

Resistance to *Botrytis cinerea* in stored beet roots [*R.A.M.*, xx, p. 332] was found to be directly correlated with an excess of nitrogen and with enzymatic activity. In the resistant roots marked differences in the activity of the enzymes of the various tissues were recorded, whereas no such disparities were observed in the diseased material. The higher the enzymatic activity, the lower was the content of transferable nitrogen and sugar. The amounts of non-protein nitrogen and monosaccharide were larger in resistant than in susceptible roots. The qualitative differences between the enzymes of resistant and non-resistant roots are indicative of variations in vitality.

Townsend (G. R.) & Wade (B. L.). **Close-up of something new in Snap Beans. Two varieties developed for Florida resist rust, mildew, common mosaic and are heat and drought tolerant.**—*Sth. Seedsm.*, vi, 3, pp. 9, 40, 1943. [Abs. in *Plant Breed. Abstr.*, xiii, 3, p. 268, 1943.]

The Florida Belle and Florida White Wax varieties, the former a selection from Stringless Black Valentine × a sib of U.S. No. 5 Refugee, back-crossed with Stringless Black Valentine, and the latter a selection from Brittle Wax × a sib of U.S. No. 5 Refugee, have been found to combine resistance to some forms of rust [*Uromyces appendiculatus*] and mildew [*Erysiphe polygoni*] with tolerance of heat and drought and other attractive qualities.

Daines (R. H.). **Thiosan (tetramethyl thiuramdisulfide) and scurf control of Sweet Potatoes.**—*Phytopathology*, xxxiii, 5, pp. 410–412, 1943.

From the data obtained in tests at the New Brunswick Agricultural Experiment Station, New Jersey, in 1942, thiosan (tetramethyl thiuramdisulphide) at the rate of 1 lb. in 5 gals. water, applied as a sprout dip, proved equally effective with semesan bel for the control of severe scurf (*Monilochaetes infuscans*) in sweet potatoes grown in a heavy sassafras loam soil. These results are of considerable interest in connexion with the prevailing scarcity of mercury and the consequent need for efficient plant-protective substitutes. Spergon afforded only a moderate degree of control [*R.A.M.*, xxi, p. 515].

Raychaudhuri (S. P.). **A disease of Pigeon Pea [Cajanus cajan (L.) Millsp.] caused by Diplodia cajani spec. nov.**—*Indian J. agric. Sci.*, xii, 6, pp. 837–847, 4 figs., 1942.

A species of *Diplodia*, apparently distinct from any hitherto described, was isolated from cankered pigeon pea plants of the 1939 and 1940 crops received from the Imperial Agricultural Research Institute, Pusa, and is named *D. cajani* n. sp. The fungus is characterized by an olive-green to brown (black in the mass) mycelium, 2·6 to 8·6 (average 4·3) μ in diameter; globose, ostiolate, erumpent pycnidia, 301 to 464 (405) μ in diameter; and bicellular, ovate, sometimes ovoid to ellipsoid conidia, 21·5 to 30·1 by 10·8 to 12·9 (25·1 by 12·7) μ, attached by the narrower end to short, needle-shaped, pale to dark brown conidiophores. The upper cell of the conidium invariably germinates first, producing a germ-tube in five hours, while a period of 15 to 20 hours is required by the lower cell for the same process.

The primary symptoms of the disease are thickening and distortion of the collar region, developing after 20 to 30 days into large, deep-seated cankers, which usually spread and girdle the stem, causing the collapse of the plant, though partial recovery through callus formation occasionally takes place. The cankered portion of the stem is often twisted owing to the unequal development of the wood, and in advanced stages of infection the internal tissues, a few inches above the lesion, are discoloured; at this site adventitious roots are produced. Microscopic examination of the slate-blue tissues (likewise a feature of the similar disease of pigeon pea described by Leach and Wright from Trinidad [*R.A.M.*, ix, p. 622]) revealed the presence of mycelium in the primary and secondary xylem vessels.

Positive results were obtained in inoculation experiments with pure cultures of four isolates of *D. cajani* on wounded and unwounded plants, the severity of the symptoms being greatly increased by previous injury to the collar.

The minimum, optimum, and maximum temperatures for the growth of the fungus on potato dextrose agar (the best of the media tested) were below 20°, 30°, and above 35° C., respectively.

Jenkins (Anna E.) & Bitancourt (A. A.). **Gouirand and Bergeron's treatment of Sphaceloma ampelinum.**—*Mycologia*, xxxv, 3, pp. 272–276, 1 fig., 1943.

Attention is drawn to a little known account of *Sphaceloma ampelinum* [*Elsinoe ampelina*: *R.A.M.*, xii, p. 595] published in 1897 by Gouirand and Bergeron, and their original line cuts are reproduced from photographs. In this account there are descriptions of stem cankers in autumn and of stages in the development of sclerotia and the manner of conidial formation from them in the spring. Jaczewski, who cites Gouirand and Bergeron, states that the sclerotia appear at the close of summer and correspond to the conidial layers that have reached a period of rest. According to him these sclerotial formations are retained in the old wounds for several years, forming each spring a new hymenial layer of conidiophores on their surfaces.

With regard to the doubt expressed by Gouirand and Bergeron and other workers, whether more than one spore can be produced from a conidiophore of *E. ampelina*, the authors maintain that descriptions and illustrations by Gouirand and Bergeron and others all point to successive and abundant production of conidia.

HUSFELD (B.). **Zur Züchtung krankheitswiderstandsfähiger Kulturpflanzen.** [A contribution to the breeding of disease-resistant cultivated plants.]—*Angew. Bot.*, xxv, 1–2, pp. 115–125, 1 fig., 1943.

Some recent outstanding contributions to the breeding of cultivated plants for resistance to specific diseases are discussed, with special reference to the work now in progress at the Müncheberg Plant Breeding Institute on the development of immunity from vine downy mildew (*Plasmopara*) [*viticola*: *R.A.M.*, xviii, p. 435]. The relation of the stage of maturity of the host to the intensity of infection has been the subject of investigation in various crops, and inoculation experiments on vine seedlings of different ages threw further light on this problem. It was observed that the selective process is more active among plants inoculated in the first and second true leaf stage than at the fifth and sixth, resistance increasing from a given phase onwards and being governed by the same hereditary factors as any other character. This type of resistance is maintained and even enhanced under field conditions.

There is another form of resistance to *P. viticola* which is dependent on the temporary state of health of the host at the moment of inoculation. For instance, an apparently resistant seedling, inoculated after re-potting, will not react by the formation of minute necrotic spots round the stomata characteristic of the same plant in an undisturbed condition, but will succumb more or less completely to the attack of the pathogen. In cases of this kind, it is not resistance itself that is inherited, but merely the capacity for responding in a certain manner to a given set of external conditions.

The main object of future plant-breeding research must, in the writer's opinion, consist in the development of 'biotype-proof' characters for resistance, so that the risk of infection by divergent physiologic races of a pathogen would be eliminated.

Agricultural Research in Utah. Report of the Agricultural Experiment Station, July 1, 1940, to June 30, 1942.—*Bull. Utah agric. Exp. Sta.* 306, 110 pp., 7 pl., [? 1942].

In this report on plant disease work in Utah from 1940 to 1942 [cf. *R.A.M.*, xx, p. 345] it is stated that there were highly significant differences in yield between 25 lucerne varieties tested for resistance to wilt (*Phytomonas* [*Corynebacterium*] *insidiosum*) [ibid., xxi, p. 527]. Of the four giving the highest yields, three were strains of Utah Station selections.

Further studies demonstrated that the condition known locally as lucerne 'stem blight' is two distinct diseases: a bacterial stem blight apparently identical with *Phytomonas* [*Pseudomonas*] *medicaginis* and a fungal disease, 'black stem', which is due to *Ascochyta imperfecta* [ibid., xviii, p. 11; xxi, p. 528]. Black stem in Utah appears to be identical with the disease of the same name in Idaho and Kentucky. In the later stages of the disease, the lesions produced by the bacterial organism may be completely invaded by the fungus.

Of the six races of wheat bunt [*Tilletia foetida* and *T. caries*] found in Utah and southern Idaho, only three occur very frequently. The race affecting Oro wheat is rather prevalent. Five races of loose smut [*Ustilago tritici*] have been isolated from collections made in Utah. Genetic studies of resistance to loose smut and bunt in wheat revealed marked transgressive segregation.

Tomato bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*) [ibid.,

xx, p. 345] continues to be effectively controlled by treating seed from infected sources with acetic acid or by extraction of the seed from pulp after fermentation [ibid., xxi, p. 353], subsequent rapid drying reducing the loss of germinability.

In further work on tomato curly top (caused by sugar beet curly top virus) [ibid., xxi, p. 230; xxii, p. 44], large-fruited selections from crosses of resistant strains of Ojo de Venado and Red Peach with commercial varieties, chiefly Stone, Baltimore, and Century (all forms of *Lycopersicum esculentum*) were obtained for the first time in 1941, and strains of *L. glandulosum*, *L. peruvianum* var. *humifusum*, and *L. p.* var. *dentatum*, that are almost immune, are being used in an intensive breeding programme. In tests of the effectiveness of different cultural methods on curly top control, the highest percentage of diseased plants in 1940 (81 per cent.) occurred in controls planted at the usual time (10th May) and with the customary spacing (42 in., one plant per hill). These plants gave one of the smallest yields (4·8 tons per acre). The least (25·5 per cent.) occurred in early planting (20th April), spaced 21 in. apart, one plant per hill, paper caps being used to afford protection against frost; these plants also gave the highest yield (19·4 tons per acre) [ibid., xxi, p. 103]. In 1941, control plots gave 16 per cent. disease and 6·1 tons per acre. Those planted at the same time, but spaced 21 in. apart showed 12 per cent. curly top and gave 8·3 tons per acre. Late sowings spaced 42, 21, 10·5, and 6 in. apart gave, respectively, 14, 11, 5, and 3·7 per cent. curly top and yields of 2·6, 3·8, 7·1, and 9·7 tons per acre. Direct seeding in 1940 gave inconclusive results. When the effect of planting at different times was investigated (10½ in. spacing), earliness was found to favour higher yields and to give less disease. Of all the irrigation methods tested, irrigation at some date after seeding (depending on soil moisture) in regular furrows appeared to give the best results. When sunlight intensity during growth was reduced by shading from 10,000 to under 2,000 foot candles the percentage of curly top in three tests fell from 51·9, 53·8, and 73·1 to 3·7, 8·8, and 7·4, respectively. Nutritional studies indicated that nitrogen may stimulate curly top.

Chlorosis of fruit trees was not satisfactorily controlled by soil treatments with acid-forming materials and minor elements. Iron sulphate sprays and injections of iron phosphate produced improvement, but occasionally the spraying was followed by heavy leaf drop. Injections gave more promising results than soil or spray treatments. Some trees injected with iron phosphate in late spring shed a few leaves, but in most cases recovery was satisfactory. Injections, however, had small effect after one season.

Soil treatments with acid-forming materials and minor elements failed to give satisfactory control of little leaf [of fruit trees], though in peach, cherry, and apple orchards the condition was controlled by zinc sulphate sprays, by zinc sulphate injections, and by the insertion of zinc tacks in the trunk. Occasionally, the symptoms reappeared the second summer after treatment. The zinc content of affected leaves was only about one-third that of normal leaves.

In 1941, western 'X' disease of peaches [ibid., xxii, p. 32] was found on 47 per cent. of the trees in 15 six- to twenty-year-old orchards. It occurs in high concentrations (up to 80 per cent. of the living trees) in six counties in Utah. The evidence indicates that nursery stock may be a means of distribution.

Rasp leaf of sweet cherry [ibid., xxii, p. 257], first discovered in Utah in June, 1941, is now known to be present in a severe form in three orchards in Davis County. Artificial transmission was obtained by bud graft inoculation.

A condition affecting cherry trees, and referred to as 'ring spot' or 'lace leaf', in which almost all the mesophyll tissues of the leaves become necrotic and fall out, was first observed in Utah in 1939. In August of that year, 20 young, healthy Bing cherry trees were inoculated with buds from affected trees, and 18 of these showed the condition in 1941.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 5, pp. 223–226, 5 figs., 1943.

During the past season, partial failure of several transplanted carrot and beet seed crops followed collapse and rotting of the main storage roots in New South Wales. After being selected for colour and shape, the roots were transplanted as soon as possible, and they appeared to start well. Many plants produced an apparently normal seed stalk, and some flowered well, but after this, further development ceased, and the seed stalks withered and collapsed. The seed roots were found to be badly shrunken, and had developed only a meagre root system after transplanting. No organism of primary importance was associated with the condition, which is attributed to the selection by growers of over-mature roots of high sugar content as seed roots.

Bacterial blight of carrots (*Pseudomonas* [*Xanthomonas*] *carotae*) [*R.A.M.*, xxii, p. 88] was observed twice in three months (once on a seed crop), probably having been recently introduced on seed from overseas. The symptoms on the leaves are irregular, dark brown spots on the segments, sometimes with a lighter halo; the leaf stalks show short brown streaks. Under conditions favouring infection, the older leaves may be killed and wither up. Severe leaf spot may reduce the yield, but light infection does not appear to affect it materially. The damage to seed crops is likely to be a more serious source of loss. Roots for seed production should be taken from a clean crop, and land which has borne an affected crop should not be used for carrots the following year.

Rhubarb wilt or crown rot (*Phytophthora parasitica*) [ibid., xv, p. 281] is recorded for the first time from New South Wales, but is so widespread that it has probably been present for some years. The disease requires hot, wet conditions; it is most common in heavy soils, and occurs first in any depression in the field where water remains. The beds should be well drained and not watered excessively. Once the disease has occurred, rhubarb should not again be grown in the affected bed for some years.

Against *Clasterosporium carpophilum* on stone fruit trees spraying with Bordeaux mixture (6–4–40) plus a spreader is recommended; the operation should be carried out when the leaves fall in autumn, and in early spring, when a trace of petal colour is visible in the swollen blossom buds. Pruning out the infected twigs is also advised.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 6, pp. 312–316, 7 figs., 1943.

For many years past, onion white rot (*Sclerotium cepivorum*) [*R.A.M.*, xxi, p. 213] has caused serious losses in metropolitan market gardens in Victoria, and the disease now appears to be spreading in the country districts. The fungus is generally introduced into clean areas by means of diseased seedlings or sets. Infection develops most rapidly at soil temperatures of 60° to 70° F., which normally occur during late autumn and spring. At soil temperatures over 75° the development of the disease is entirely inhibited. In country districts farmers should discontinue onion-growing on infected land for an indefinite period, or lengthen the rotation between onion crops; infected bulbs should be burnt, and no infected refuse should be fed to stock. In market-gardens, on the other hand, the parasite could be readily controlled in the seed-beds by sterilizing the soil with formalin.

To control rhubarb downy mildew (*Peronospora jaapiana*) [ibid., xv, p. 422] the lower leaves of affected plants should be stripped off, exposing the crowns, and the plants should be thoroughly sprayed with Bordeaux mixture (4–4–40), care being taken to drench the under surfaces of the leaves. Treatment should be repeated at intervals of two or three weeks throughout spring and early summer.

Brief notes are also given on gladiolus bacterial scab [*Bacterium marginatum*: ibid., xx, p. 558].

Michaelis (M.), Levi (I.), & Hibbert (H.). **Differential inhibition between normal and tumor (crown gall) tissue in Beet roots.**—*Science*, N.S., xcviii, 2534, pp. 89–90, 1943.

The authors observed a clear difference in the action of resorcinol and of cyanide upon the rate of oxygen uptake in the tissues of normal beets and of beet root tumours resulting from inoculation with *Phytomonas* [*Bacterium*] *tumefaciens*. With normal tissue an inhibition of 12 to 14 per cent. was obtained with 0·0166 M resorcinol, while in tumour tissue the figure was 20 to 23 per cent. Cyanide in concentrations of 0·0166 M inhibited the oxygen uptake by 84 to 86 per cent. in normal, and by 79 to 80 per cent. in tumour, tissue. Other studies in the same laboratory had shown a differentiation between the healthy part and the tumorous part of the same beet, whereas this work revealed a differentiation between tumorous tissue and the tissue of a completely healthy non-infected beet root. When cyanide was added to resorcinol and vice versa, with both healthy and tumorous beet root tissue inhibition was increased by 6 to 8 per cent. above that due to cyanide alone.

These results indicate that both tumours and healthy beets may have a cyanide-insensitive respiratory system, a resorcinol-insensitive system, and a cyanide-plus resorcinol-insensitive system, as well as the corresponding sensitive systems, the relative proportions of the three systems in tumour and healthy tissue being different. They also suggest that the inhibitions induced by cyanide and by resorcinol function to some extent independently. Possibly, different active centres of the same enzyme may be attacked by both inhibitors, but to a different degree.

Weiss (F.) & Wood (Jessie I.). **A list of names and synonyms of phytopathogenic bacteria occurring in the United States embodying recent changes in nomenclature.**—*Plant Dis. Reptr*, xxvii, 2, pp. 42–62, 1943. [Mimeographed.]

The authors list the names of phytopathogenic bacteria [cf. *R.A.M.*, xxi, p. 364], that have been adopted by the Plant Disease Survey pending the appearance of a new edition of Bergey's Manual [ibid., xix, p. 203]. Synonyms are given, and an index of specific names is provided.

No change is made as regards *Erwinia*. Because of the confused status of the name *Bacterium*, it is employed in the present list only for species not allocated to other genera. All species of *Phytomonas* (except two so far not transferred elsewhere and four recently added) are reduced to synonymy. The genus *Agrobacterium* [ibid., xxii, p. 344] is accepted for *A. rhizogenes* (Riker *et al.*) Conn (*Bact. rhizogenes*) and *A. tumefaciens* (E. F. Sm. & Town.) Conn, but the transference of *Bact. stewarti* to *Xanthomonas* is not approved; *Corynebacterium* is adopted for the seven plant pathogens so far transferred to this genus, the combination *C. sepedonicum* (Spink & Kotth.) Skapt. & Burkh. published in May, 1942 [ibid., xxi, p. 469] antedating that made by Dowson in June, 1942 [ibid., xxi, p. 365].

Posnette (A. F.). **Control measures against swollen shoot virus disease of Cacao.**—*Trop. Agriculture, Trin.*, xx, 6, pp. 116–123, 1943.

In this report on the results obtained in the control of cacao swollen shoot [*R.A.M.*, xxii, p. 13] at the Central Cocoa Research Station, Tafo, Gold Coast, the author points out that spread may occur gradually, by the infection of trees adjacent to others already diseased, no healthy tree remaining inside the affected area, or it may take place also by new outbreaks some distance away from the main one; these enlarge like the original one, the rate of spread increasing until the whole farm is destroyed. These subsidiary outbreaks probably arise from the dispersal of insect vectors from the original one, but they may, possibly, be fresh infections from an alternate host. In an isolated outbreak in which both methods

of spread were allowed to take their course, the affected area increased from 1,000 sq. yds. in 1937 to 20,000 sq. yds. in 1943.

In the experimental area (near the edge of the most heavily infected locality), which comprised about 70 acres of trees 5 to 30 years old, the first outbreak was noted in December, 1938. An eradication campaign was begun in February, 1940, when 11 outbreaks affecting 55 trees were known. All the trees showing characteristic swellings were cut down and stumped, but this method proved a failure. In February, 1941, when there were 28 outbreaks, a ring of apparently healthy trees was removed from 24 treated outbreaks. This proved more effective. After May, 1941, each plot was inspected every month, and any infection appearing after an old outbreak had been free for six months was regarded as a new outbreak. On this assumption, 39 outbreaks had been cleared up by March, 1942, and only four were still spreading.

The roguing of infected trees in 1940 and 1941 eliminated the virus from the Station cacao, but failed to reduce the number of new outbreaks, the increase in which from 10 in 1939 to 50 in 1942 indicates that infection is rapidly becoming more concentrated in the Tafo area. In 1942–3, continued treatment eradicated the disease from all but three of the 75 outbreaks treated over six months earlier. The total number of infected trees fell from nearly 400 in 1940 to 133 in 1942–3, in spite of the increase in the number of outbreaks. It appears that some outbreaks affecting not more than six trees can be controlled without the removal of apparently healthy trees.

An experiment was carried out on native farms to test practicable improvements in these routine methods, including the removal of two rings of healthy trees instead of one, burning the leaves and green wood immediately after felling, and nicotine-spraying before and during felling. None of these methods appeared likely in one operation to eliminate the virus from extensive areas.

The results of the investigation are considered to justify the official eradication campaign, in which the fringes of the infected areas are surveyed, and as isolated outbreaks appear, all the newly infected trees, with a ring of apparently healthy ones, are cut down and stumped, growers being compensated only for the healthy trees. The present control measures, however, can do no more than delay the destruction of the cacao. It is to be hoped that a resistant variety will eventually be found.

Vallega (J.). **Razas fisiológicas de Puccinia triticina y P. graminis tritici communes en Chile.** [Physiologic races of *Puccinia triticina* and *P. graminis tritici* common in Chile.]—*Tec. Bol. Minist. Agric. Chile* 3, 32 pp., 3 figs., 1942. [English summary. Abs. in *Exp. Sta. Rec.*, lxxxix, 2, p. 226, 1943.]

Of the four physiologic races of *Puccinia graminis tritici* collected on wheat in Chile during 1940, viz., 14, 15, 17, and 11 [*R.A.M.*, xxi, p. 188], the first was the most virulent. Race 68 of *P. triticina* was the most prevalent and widespread, but 15 and 114 (the latter new and highly pathogenic to seven of the eight differential varieties) were also present. Although the same races of stem and leaf rusts occur in Chile and the La Plata region, none of the Chilean races of *P. triticina* has hitherto been detected in the Argentine, Uruguay, or Brazil. Among the wheat varieties grown in Chile are many factors for rust resistance which it is hoped to utilize for breeding purposes.

Hart (Helen) & Allison (J. L.). **A browning reaction to stem rust in Wheat.**—*Phytopathology*, xxxiii, 6, pp. 484–496, 4 figs., 1943.

The browning reaction of wheat to infection by *Puccinia graminis tritici* consists of a deep brown discoloration of the host tissue about the infection centre, usually accompanied by reduced sporulation of the rust. Studies on this type of reaction

showed that it is found only in certain wheat varieties (e.g., Vernal emmer, Arnautka, Kubanka, Kota, and Kanred), but is not a varietal character, its expression depending on the race of rust and the environmental conditions. During the three or four years it was observed that whenever collections of race 34 were cultured in the greenhouse, browning was frequent. This race, whether collected from wheat or barberry, appeared capable of inducing the reaction in a greater number of different wheat hosts than any other race tested. Temperatures above 28·5° C. were ascertained to be the primary environmental condition directly responsible for browning. High relative humidity enhanced the effects of high temperature.

Histological studies demonstrated that in the browned area of most hosts most of the haustoria were dark, thick-walled, and very numerous. Near the outer margins of mycelial development, the cell walls were discoloured in groups of 5 to 15; the host cell walls were brown and slightly thickened in many instances. The tips of some of the intercellular hyphae were discoloured and sometimes transformed and ensheathed, as were the haustoria. The transformed parts showed a striking resemblance to uredospores and teleutospores. When the uredospores of race 34 germinated at high temperatures, some tendency towards spore-like encystment of the germ-tubes was noted.

In resistant hosts the browning reaction is only an added indication of resistance, whereas in susceptible hosts a severe reaction of this type may denote a definite shift from susceptibility to resistance. It is possible that such a variation as this browning reaction has been one of the factors responsible for the fact that race 34 no longer plays an important part in stem rust epidemics in the Mississippi Valley.

Johnson (T.) & Newton (Margaret). **The inheritance of a mutant character in Puccinia graminis tritici.**—*Canad. J. Res.*, Sect. C, xxi, 7, pp. 205–210, 1 pl., 1943.

A study was made at Winnipeg, Canada, of the inheritance of an abnormal characteristic of *Puccinia graminis tritici*, originally encountered in 1934 in a culture of race 21, namely, the production on barberry of white haploid pustules that develop few or no pycnidia and rarely produce aecidia but occasionally give rise to uredosori and teleutosori [*R.A.M.*, xvi, p. 520]. Of the pustules produced in cultures of race 21, 52·6 per cent. were normal and 47·4 per cent. were white. In selfing and crossing experiments with races 21, 11, 17, and 48, it was demonstrated that diploidization of the mycelia of normal pustules by pycnospores from white pustules initiated physiologic races that produced white and normal pustules on the barberry in approximately equal numbers; normal × normal matings produced normal races; and white × white matings were sterile. Uredosori which occasionally arose in white pustules as a result of diploidization by either pycnospores or mycelia of normal pustules also gave rise to physiologic races which produced white and normal pustules in about equal numbers. It thus appears that the production of white pustules is not restricted to one particular physiologic race or to one sex. It is assumed that a mutation affecting one of the conjugate nuclei took place in the original culture of race 21 and that, during meiotic divisions in the germinating teleutospore, the mutant factor is segregated so that half the sporidia give rise to white and half to normal pustules.

Wöstmann (E.). **Der fluorescenzoptische Nachweis von Ustilago tritici im Weizenkorn.** [The detection of *Ustilago tritici* in the Wheat grain by optical fluorescence.]—*Kühn-Arch.*, lvi, pp. 247–253, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 14, p. 1485, 1943.]

The mycelium of *Ustilago tritici* was found to be discernible in the wheat grain

by means of fluorescence microscopy. Of the various dyes tested, the most effective were coriphosphin (in alkaline solution for the staining of the embryo) and fuchsin (in acid solution for the after-treatment of the mycelium). The infected grain is soaked for four to six hours, whereupon frozen microtome sections, 40 μ thick, are placed on a slide with a drop of sodium phosphate solution, stained for two minutes with coriphosphin (1 in 1,000 in sodium phosphate), rinsed, restained for 15 seconds in fuchsin (1 in 10,000 in potassium dihydrogen phosphate), and again rinsed. The preparation is then embedded in glycerine, and on inspection the next day through fluorescent light the mycelium appears a vivid reddish-purple in contrast to the greenish-yellow embryonic tissue.

White (N. H.) & McIntyre (G. A.). **The pathogenicity of single spore isolates of Ophiobolus graminis under field conditions.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 2, pp. 93–94, 1943.

In a preliminary experiment carried out at Canberra to test the pathogenicity under field conditions of eight isolates of *Ophiobolus graminis* derived from eight ascospores from a single ascus, sites were selected in a field which two years before had carried a crop of wheat affected by take-all, but which had lain fallow the year before. The isolates were introduced into the soil in three types of inoculum, (*a*) straw, (*b*) oat-barley, and (*c*) soil. Two adjacent sites were selected, one being on a light-coloured, and the other on a dark-coloured, sandy loam.

Statistical analysis of the percentages of diseased wheat plants in the different treatments showed that variations in pathogenicity of the eight isolates [*R.A.M.*, xxi, p. 520] were significantly different for a particular medium, that those relative differences were not the same for different media, and that the effectiveness of the inoculum varied with site conditions.

Sallans (B. J.) & Ledingham (R. J.). **An outbreak of common root rot in south-western Saskatchewan in 1942.**—*Sci. Agric.*, xxiii, 10, pp. 589–597, 1 fig., 3 graphs, 1943.

An unusually severe outbreak of common root rot of wheat [*R.A.M.*, xxii, p. 200] is reported from south-western Saskatchewan, Canada. A study of the disease showed that while the root-rot fungi, *Helminthosporium sativum* and possibly *Fusarium* spp., were primarily responsible for the outbreak, other factors, such as drought and perhaps wind erosion and soil variations, were undoubtedly contributory to the intensity of the attack. Throughout the study square yard samples from apparently healthy areas were used as standards of comparison with paired samples from diseased patches in the same field, but it is pointed out that the areas designated as healthy in appearance were actually also diseased, though to a lesser degree, and had probably suffered some reductions in yield. The prematurely ripened, stunted, and discoloured plants from diseased patches were found to yield about half as much grain as those from apparently healthy ones, and the weight per thousand kernels of diseased plants was lower by about 28 per cent. The losses in yield in diseased patches ranged from 8 to 42 per cent. of what the yield might have been if the fields were uniformly like the apparently healthy areas. Common root-rot ratings were much higher for the diseased areas than for the apparently healthy ones, indicating that a straight-line relation exists between yield and disease ratings.

Glynne (Mary D.) & Ritchie (Wendy M.). **Sharp eyespot of Wheat caused by Corticium (Rhizoctonia) solani.**—*Nature, Lond.*, clii, 3849, p. 161, 1943.

Lesions on wheat somewhat resembling those due to *Cercosporella herpotrichoides*, but less regular, have been recognized at Rothamsted as symptomatic of a different

disease since 1935. This was described and figured in Holland by Oort under the name 'sharp eye spot' in the course of his paper on *C. herpotrichoides* [*R.A.M.*, xvi, p. 29], though he did not identify the causal organism. Sprague found a species of *Rhizoctonia* causing similar symptoms in Oregon [ibid., xvi, p. 801]. Blair observed that some Canadian strains of *Corticium solani* when inoculated into wheat caused a stem girdling, the photographs of which resemble sharp eye spot [ibid., xxi, p. 412].

The authors have obtained wheat plants with sharp eye spot resembling that figured by Oort, Sprague, and Blair from many places in England and Wales, and have consistently isolated a fungus of the *Rhizoctonia* type. Wheat seedlings inoculated with six isolates from four localities produced sharp eye spot lesions from which *C. solani* was re-isolated. Sharp eye spot lesions are more superficial than ordinary eye spot and may be confined to the outer sheaths, though they may penetrate the straw. They frequently run several inches up the stem. They are asymmetrical, with sharply defined borders surrounding pale areas on which patches of light, later brown or purple, mycelium grow and spread. Sharp eye spot is seldom present in England and Wales in more than 1 per cent. of the straws, though one heavily infected crop has been reported. It does not increase with the frequency of wheat or barley in the rotations. It is as common in the first wheat crop after grass as it is on old arable land.

IMMER (F. R.) & CHRISTENSEN (J. J.). **Studies on susceptibility of varieties and strains of Barley to Fusarium and Helminthosporium kernel blight when tested under muslin tents or in nurseries.**—*J. Amer. Soc. Agron.*, xxxv, 6, pp. 515–522, 1943.

Strains and varieties of barley, including Peatland, Velvet, Barbless, and a number of crosses between Minn. No. 462 and Peatland, were tested separately from 1937 to 1939, at the Minnesota Agricultural Experiment Station, both in a muslin tent and in a field nursery for their reaction to head or kernel blight, caused principally by *Helminthosporium sativum* and *Gibberella zeae*, one of the most destructive diseases of the crop in the north-central United States [*R.A.M.*, xiv, p. 503].

In seven out of ten tent tests a significant negative regression of blight on date of heading was obtained, the coefficients varying from +0·7214 to −7·0868, indicating that as the date of heading was delayed one day, the average reduction in the incidence of infection was 7 per cent. In nine out of the ten trials the strains differed significantly in their response to the pathogens after adjustment for date of heading to obviate the selection of late-heading but not necessarily blight-resistant strains. In tent and three nursery tests on 18 varieties or strains Peatland developed a relatively low percentage of infection in all the tests (0 to 42, compared with 5 to 90 and 15 to 86 for Velvet and Barbless, respectively). The strain II–31–71 (Minn. No. 462 × Peatland) was slightly more susceptible than the latter parent (2 to 53 per cent.), but showed less than the average infection of all strains in seven out of eight tests, whereas II–31–16 of the same cross had a higher percentage of both types of blight in the same number of trials (12 to 98). Generally speaking, there is a correlation between resistance to *H. sativum* and *G. zeae*, so that the same technique may be used for testing varietal response to both pathogens.

YU (T. F.). **Breeding hulled Barley for resistance to covered smut [Ustilago hordei (Pers.) K. and S.] in Kiangsu Province.**—*Nanking J.*, ix, pp. 281–292, 1940.

Covered smut of barley (*Ustilago hordei*) is stated to cause a loss of 1,000,000 to 1,500,000 bush. grain in Kiangsu Province annually. A detailed study was made

of the pathogenicity of 280 collections on three varieties, Hanna, Nanking 373, and Saitamachadaha. Five different races were found and named C–1, C–2, C–3, C–4, and C–5, the first two being closely related in pathogenicity and comprising 93·2 per cent. of all the collections. The three remaining forms were found chiefly in the northern part of the province.

Out of more than 9,000 individual heads of Chinese barley selections, 54 lines were found resistant, of which nine yielded more heavily than the check (a productive strain grown extensively in Kiangsu). Selections from the progeny of Manchuria (C.I.957) × No. 4326 (a local selection) also yielded resistant types. Seven such hybrids, named Nanking 555, 557, 562, 575, 580, 592, and 593, all yield highly and mature earlier than Manchuria. The variety Nanking 593 is considered the most promising.

Twyman (E. S.). **Manganese deficiency in Oats.**—*Nature, Lond.*, clii, 3851, p. 216, 1943.

With the help of the water culture technique of Stout and Arnon (*Amer. J. Bot.*, xxvi, p. 144, 1939) the author succeeded in producing typical symptoms of grey speck disease [*R.A.M.*, xxi, p. 522] in oats plants grown in culture solutions deficient in manganese. The experimental results also suggest that in addition to the four generally recognized trace elements, manganese, zinc, boron, and copper, one or more elements from among aluminium, molybdenum, titanium, vanadium, tungsten, nickel, and cobalt are probably essential for the growth of oats.

Dillon Weston (W. A. R.) & Taylor (R. E.). **Stripe smut of Rye.**—*Nature, Lond.*, clii, 3849, pp. 160–161, 1943.

Infection of rye by stripe smut (*Urocystis occulta*) [*R.A.M.*, xx, p. 569] has been observed on several occasions lately in Norfolk, some 80 acres being moderately affected on one farm. The disease is rare in Great Britain, and has not been observed by the senior writer for 20 years in East Anglia. It appeared, however, at Rothamsted in 1932, and a small amount was found near Romsey, Hampshire, in 1920, and at Askham Bryan, Yorkshire, in 1936. Rye seed should be preventively treated with a reliable organo-mercuric dressing against this and other diseases; where the disease is found, rye should not be grown in the same field the following season.

Thomas (K. M.) & Ramakrishnan (T. S.). **Experiments on ergot production in Madras.**—*Madras agric. J.*, xxx, 12, pp. 411–416, 4 figs., 1942.

After referring to the discovery of ergot sclerotia near Simla, India, in 1941 on *Brachypodium sylvaticum*, *Oplismenus compositus*, and *Andropogon* (?) *gryllus*, belonging probably to *Claviceps purpurea* or *C. pusilla* [*R.A.M.*, xxi, p. 206], the authors state that following the appeal of the British Ministry of Health in 1941 for large quantities of ergot, several parts of the Empire made trials in ergot culture by means of the artificial inoculation of rye flowers [cf. ibid., xxii, p. 300]. 'The rye fungus not being recorded in India, cultures of the fungus were obtained in April, 1942, from Australia and exploratory experiments were carried out at the Agricultural Research Station, Narjanad.' The fungus was multiplied on a variety of media, over 2½ acres of rye were sown, and inoculation by spraying carried out in mid-July and again on the 11th August. Fifteen days after the second spraying several sclerotia were found, and infection subsequently spread over the whole field, including the unsprayed blocks. Infection was heaviest in the fields that flowered last. The yield figures showed that up to 120 lb. of sclerotia (wet weight), equivalent to 95 lb. of sun-dried sclerotia, could be produced per acre under favourable conditions. The alkaloid content compared very favourably with that of the best European ergots.

The best culture medium for the fungus was found to be that recommended by Kirchhoff [ibid., viii, p. 560], while another good one was that used by Kreitmair and Küssner [ibid., xi, p. 38], consisting of rye meal, asparagin, glycerine, and water, and a third was one composed of sterilized immature panicles of sorghum, *Setaria italica*, and *Pennisetum typhoides*. The optimum growth temperature was about 20° C.

The cost of production under optimum conditions on the Nilgiris will apparently work out at about Re 0–4–0 per pound of dried ergot. Estimating the yield at only 50 lb. per acre and the selling price 6 rupees per pound, the gross return per acre would be 300 rupees.

Diplodia ear rot of Maize.—*Trop. Agriculturist*, xcviii, 3, p. 36, 1942.

Maize cobs from an up-country estate in Ceylon were found to be rotted and blackened as a result of infection by *Diplodia frumenti* [*R.A.M.*, xvii, p. 670]. This is the first record of the fungus for Ceylon, and it has not, apparently, been found before outside the United States and Tanganyika [ibid., xii, p. 552]. It is recommended that no seed from diseased crops should be sown, that rotation should be practised in fields that have borne an affected crop and no maize planted for at least one year, and that after harvest the infected cobs should be burnt, while the stalks should be burnt *in situ* or used to make compost. Further outbreaks are to be reported to the Plant Pathologist.

Hoppe (P. E.). **Scolecospores in Diplodia macrospora.**—*Phytopathology*, xxxiii, 6, p. 528, 1943.

A culture of *Diplodia macrospora* [*R.A.M.*, xxii, p. 301] with abundant scolecospores [cf. ibid., xviii, p. 307] was found in platings of rotted maize kernels from a market sample of the 1942 crop from Wye Mills, Maryland. Scolecospores have not before been reported in *D. macrospora*, and this is also the first record of the fungus from Maryland.

Johann (Helen). **Phoma terrestris in the roots of mature Maize plants.**—*Phytopathology*, xxxiii, 6, pp. 526–528, 1 fig., 1943.

In the autumns of 1941 and 1942, *Phoma terrestris* was isolated from pink roots of mature yellow dent maize plants growing in the field at Madison, Wisconsin; the fungus was found alone, and in combination with *Fusarium moniliforme* [*Gibberella fujikuroi*], *Pythium* sp., and miscellaneous fungi. The rose-coloured hyphae and olive-brown pycnidial primordia characteristic of *P. terrestris* were visible in the root tissues. The slender, pink hyphae had penetrated the stele and the pycnidial primordia were most commonly noted in the cortical layers, within the cells of the endodermis, and in the small rootlets. The rose colour of the hyphae remained unaltered during killing, dehydration, and embedding. The fungus was isolated from the plants of several single crosses, among which there seemed to be some differences in susceptibility to the root injury.

Leukel (R. W.), Melchers (L. E.), & Swanson (A. F.). **Weak neck in Sorghum.**—*J. Amer. Soc. Agron.*, xxxv, 2, pp. 163–165, 1943.

The results of five years' laboratory, greenhouse, and field observations on 'weak neck' of sorghum [*R.A.M.*, xx, p. 529], furnish no evidence of a pathogenic origin of the condition, which is one of over-maturity, accompanied by weakness of the rachids and peduncles, especially of the primary culm in certain varieties, e.g., Colby. The sheath surrounding the base of the peduncle is usually filled with a slimy liquid containing various micro-organisms, including *Fusarium moniliforme* [*Gibberella fujikuroi*], *Helminthosporium* spp., and *Alternaria* spp., which subsequently invade the tissues and aggravate the final stages of the disease.

The remedy for this largely varietal trouble appears to lie in the development of strains ripening more in the manner of sorgo and kafir than in that of milo, and a measure of success has already been achieved in the selection of Westlane and Kalo H C 617. Another hopeful possibility consists in the breeding of strains with more strengthening tissue to support the head after the peduncle is dry, the present practice of combine harvesting involving delay until cold weather has shrivelled the culms sufficiently for safe storage.

WEI (C. T.). **Storage diseases of Sweet Oranges in Szechuan.**—*Nanking J.*, ix, pp. 239–268, 1940.

The symptoms and morphology of the causal organisms of the storage diseases of sweet oranges from Chintang, Chiangtsin, and Nanchung in 1938, 1939, and 1940 are described. The most serious disease in Chintang and Chiangtsin was stem-end rot caused by *Phomopsis* [*Diaporthe*] *citri*. In Nanchung, blue mould (*Penicillium italicum*) was most destructive. A form of this fungus, differing from the type in its white colonies, is proposed as a new variety, *P. italicum* var. *album* Wei. In the warmer months of April and May, black rots caused by *Phoma citricarpa* and *Alternaria citri* are common in fruits from Chintang, and stem-end rot (*Diplodia natalensis*) and *Fusarium* rotting prevalent in Nanchung. The author finds that the symptoms and spore size of *P. citricarpa* var. *mihan* Hara are variable factors dependent on the mode of infection and the nutrient media, respectively, and reduces the variety to synonymy with the type. Other fungi causing rots of minor importance are *Penicillium digitatum*, *P. fructigenum*, *Phytophthora citrophthora*, *P. parasitica*, *Colletotrichum gloeosporioides*, *Macrophoma kuwatsukaii* Hara, *Trichoderma viride*, *Botrytis cinerea*, and *Phoma citri* Sacc.

WEI (C. T.) & HU (K. H.). **A preliminary report on the control of storage rots of Sweet Oranges.**—*Nanking J.*, xi, pp. 79–102, 1942.

The most common storage rots of sweet oranges in Szechuan Province are those caused by *Penicillium italicum* and *Phomopsis* [*Diaporthe*] *citri*. Experiments were conducted to determine the value of crude borax, produced in Sikang, and crude sodium carbonate, manufactured in Chiatung from sodium sulphate, in their control. Treatment consisted of washing the fruits in 0·15 per cent. soap solution to remove dirt, draining off the free water, and dipping in the solution for five minutes at 110° F., draining, drying gently, blotting with a cloth, and finally wrapping with paper impregnated with tung oil. The crude borax, which contained 61·98 per cent. borax and 17 per cent. more soluble sodium compounds, was statistically more effective in a 5 per cent. solution than pure borax (13·4 per cent. rotting with the former as compared with 19 per cent. with the latter and 41·9 per cent. in the untreated). Borax-boracic acid mixture (2 : 1) gave a slightly better result than crude borax, 12·2 per cent. rotting being recorded, but the difference was not significant. Pure sodium bicarbonate (3 per cent.) slightly reduced infection, but the crude bicarbonate was of no value. The efficacy of the chemicals is attributed to the formation of a protective layer preventing spore germination, rather than to spore destruction.

BROOKS (C.). **Prevention of stem-end rot.**—*Proc. Fla hort. Soc.*, liv, pp. 61–63, 1941; lv, pp. 61–69, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 16, p. 4149, 1943.]

Oranges treated with ethylene [*R.A.M.*, xvi, p. 744] for 42 hours at 82° F. and a relative humidity of 87 to 92 per cent. under continuous ventilation, and then stored at 70° for a fortnight, developed 27 per cent. stem-end rot (*Diplodia*) [*natalensis*] compared with 2·5 per cent. in the controls. Fruit to which borax was applied before the ethylene treatment contracted 2 per cent. stem-end rot in a fortnight, the corresponding figures for the lots treated with borax after ethylene

and with ethylene and no borax being 7 and 14 per cent., respectively. Sodium ortho-phenylphenate (two minutes' immersion followed by immediate washing to prevent peel injury) did not impair the efficacy of the subsequent ethylene treatment, and reduced stem-rot to 3·2 or 2·5 per cent. according to whether it was applied before or after the latter. Concentrations of phenate exceeding 1·2 per cent. caused injury at 100°, and slightly better results were given by a 2 per cent. solution at 80°. Raising the temperature with a given concentration increased damage to the fruit more rapidly than disease control.

DESCHIENS (R.) & LAMY (L.). **Sur les facteurs déterminant l'apparition des pièges chez les Hyphomycètes prédateurs de nématodes.** [On the factors governing the development of the 'garrotting' apparatus in the Hyphomycetes preying on nematodes.]—*C.R. Acad. Sci., Paris*, ccxv, 19, pp. 450–452, 1942.

Dactylella bembicodes, one of the group of nematode-destroying Hyphomycetes [*R.A.M.*, xxii, p. 306], was stimulated to the more or less abundant production of the 'garrotting' apparatus by the addition to agar cultures at 20° to 25° C. of filtered aqueous extracts of animal origin, including guinea-pig serum and various internal organs (1 in 10 and 1 in 100), and snail (*Helix pomatia*) at 1 in 10, the period required being five days. The stimulatory substances, the nature of which is still under investigation, are thermostable, withstanding over 1½ hours' exposure to a temperature of 120°, and do not succumb completely to the action either of ethyl or methyl alcohol. No comparable effect was exercised by the various plant extracts tested.

DRECHSLER (C.). **A new non-helicoid bisporous Helicocephalum parasitizing nematode eggs.**—*Mycologia*, xxxv, 2, pp. 134–141, 1 fig., 1943.

Latin and English diagnoses, supplemented by a full account of the morphology of the fungus, are given of *Helicocephalum diplosporum* n.sp., found destroying and consuming nematode eggs in decaying leaves of *Poa pratensis* in Virginia. On encountering a nematode egg, a hypha produces an appressorium in contact with it. This perforates the egg integument and intrudes a haustorium composed of flexuous assimilative filaments.

ULLYETT (G. C.) & SCHONKEN (D. B.). **A fungus disease of Plutella maculipennis Curt. in South Africa, with notes on the use of entomogenous fungi in insect control.**—*Sci. Bull. S. Afr. Dep. Agric.* 218, 24 pp., 5 figs., 3 graphs, 1940. [Received March, 1943.]

The larvae of *Plutella maculipennis* Curt. in South Africa are subject to infection by *Entomophthora sphaerosperma* [*R.A.M.*, xviii, p. 140], the hyphae of which penetrate the integument and enter the body-cavity, the preliminary dissolution of the chitinous layer of the cuticle being effected by means of an enzymatic secretion. Reproductive organs are formed only after the death of the host, the propagation of the fungus taking place both asexually and sexually. In the former case it is secured by (*a*) the free conidia borne on aerial hyphae emerging from the insect's body, and (*b*) the thick-walled resting spores (azygospores) produced from short hyphal segments within the larva; in the latter, by the thick-walled zygospores. At this stage the mycelium has entirely disappeared, and the spores constitute the sole remains of the fungus within the mummified larva. The conidia are abstricted at maturity and come to rest on the cabbage leaf surface immediately surrounding the dead larva. Germination proceeds rapidly in the presence of sufficient moisture, the primary conidia giving rise to secondary ones which may in turn produce a tertiary crop. During a wet summer the life-cycle of *E. sphaerosperma* may be completed in three days from the initial penetration

of the host, so that the decimation of whole populations of the latter, familiar under optimum conditions for the parasite, is readily intelligible.

E. sphaerosperma was successfully grown from mycelium on a semi-liquid glucose-gelatine medium with a trace of peptone, and in inoculation experiments the conidia were applied with a wet brush to the body of the larva. Adult insects were much more susceptible than young ones, the change in reaction with advancing age being tentatively attributed to the elimination from the blood stream of some factor or factors antagonistic to the pathogen in the juvenile larvae.

The results of a statistical and theoretical study of the interrelationships between *E. sphaerosperma*, *P. maculipennis*, and the insect parasite of the latter (a species of *Angitia*) indicated that the fungus, while introducing a factor exerting a temporarily lethal effect on its host, ultimately disturbs the existing equilibrium by destroying the predator, either directly by preventing it from reaching maturity on infested insects or indirectly by reducing the numbers of available hosts. The predator normally acts as a constant check to the expansion of the cabbage pest and the resultant increase in the average density of *P. maculipennis* at the expense of its parasite resulted in serious economic damage to the crop. Such being the case, the application of *E. sphaerosperma* to the control of *P. maculipennis* can only be regarded, at any rate under Transvaal conditions, in the light of a temporary measure for use in special circumstances and not as part of the normal campaign of extermination.

LLOYD (F. E.). **The carnivorous plants.**—xv+352 pp., 38 pl., 12 figs., Waltham, Mass., U.S.A., The Chronica Botanica Company, 1942. $6.

This work includes (pp. 169–176) a chapter on carnivorous fungi, which deals with their occurrence, habit, glands, secretion, and digestion, and to which a list of 39 references is appended. Many of these are to papers by C. Drechsler, which have been noticed from time to time in this *Review*.

JOHANSEN (GUDRUN). **Hørsygdomme.** [Flax diseases.]—*Nord. JordbrForskn.*, xxiv, 1–2, pp. 34–49, 4 figs., 1942.

The three principal seed-borne diseases of flax in Denmark are those caused by *Sphaerella linorum*, *Colletotrichum lini* [*C. linicola*], and *Polyspora lini*, the first records of which for the country date from 1940, 1939, and 1937, respectively. The symptomatology, life-history, and mode of infection of all three pathogens are described. From 1940 to 1942 samples of seed intended for propagation were inspected for the presence of *C. linicola* and *P. lini*, 100 seeds from each batch being cultured on potato dextrose agar: the average incidence of the two fungi in the three years was 8 and 3, 4 and 0·4, and 3 and 0·5 per cent., respectively. The amount of infection, based on a scale of 0 to 5, by *P. lini* in fields sown with healthy, slightly (1 to 3 per cent.), and heavily infested (17 to 18 per cent.) seed was 0·11, 0·67, and 1·90, respectively. As was to be expected, the incidence of seed infection rose with the degree of stem infestation in 40 samples examined, the percentage of *P. lini* in seed from stems with index figures for infection of 0, 0·1 to 0·4, 0·5 to 1, and over 1 being 0·3, 6·1, 19·4, and 50·7, respectively, while the corresponding figures for *C. linicola* were 0·2, 0·6, 0·6, and 2 per cent., respectively. In an experiment to determine the cumulative effect of *P. lini* on its host, the Stormont Cirrus and Stormont Gossamer varieties were grown for periods of one to five years on a farm at Lyngby. At the second inspection on 16th August, 1940, the percentages of stem infection on Cirrus in the one-, two-, three-, four-, and five-year plots were 84, 90·1, 96·5, 95·1, and 98·2, respectively, the corresponding figures for Gossamer being 75·9, 94·4, 92·5, 94, and 96·4, respectively. Inoculation experiments with monospore cultures of *C. linicola*, *S. linorum*, and *P. lini* on flax seedlings resulted in 100, 70, and 48 per cent. infection, respectively.

An account is further given of the ubiquitous rust *Melampsora lini*, which is not seed-borne. *Fusarium lini* is unlikely to cause severe damage in Denmark, where the high temperatures essential to its active spread do not occur. *Phoma*, *Pythium*, *Rhizoctonia*, and other *F.* spp. are all concerned in the damage sustained by flax in the early stages of growth, while among its facultative parasites may be mentioned *Alternaria*, *Macrosporium*, and *Cladosporium* spp.

At the beginning of July, 1940, flax plants exhibiting the typical symptoms of grey speck (manganese deficiency) were submitted for inspection from various parts of the country. Soil analyses having revealed a low manganese index in three of the affected fields, the element was supplied (in the form of sulphate) at a dose of 50 kg. per ha. with completely successful results.

STAPEL (C.). **Afsvampning af Hørfrø.** [Flax seed disinfection.]—*Nord. Jordbr-Forskn.*, xxiv, 1–2, pp. 50–59, 1942.

Particulars are given of experiments carried out in Denmark on the control of seed-borne diseases of flax [see preceding abstract] by dusting with mercury-containing preparations. In 1940 a batch of seed fairly heavily infected by *Colletotrichum lini* [*C. linicola*] was treated with one of these dusts at the rate of 200 gm. per 100 kg., a small amount of steam being used to bind the fungicide to the seed, which was sown on 24th May. The initial check to germination observed a week after sowing was overcome during the next week, when the ratio of emergence of untreated to dusted seed was 100 : 123; at the same time the incidence of primary infection on the cotyledonary leaves of the controls was 12·2 per cent. compared with complete freedom from attack on those of the disinfected material.

Two lots of seed infected by *Polyspora lini*, one heavily and the other lightly, were also treated with two dusts (200 gm.), A and B, with paraffin oil (500 gm. per 100 kg. seed) as a 'binder'. The treatment, while retarding the rate of germination, did not impair the absolute germinative capacity of the seed. As regards the control of light primary infection, the final counts on 11th June (sowing date 7th May) were 23·6, 6·1, and 9·1 per cent. for the untreated plots and those dusted with A and B, respectively, the corresponding figures for heavy attack being 60·6, 30·9, and 30·3, respectively. Secondary infection was less effectively combated, 95 to 99 per cent. of the straw of both treated and untreated plots being diseased, although the quality of the former was definitely superior to that of the latter and 39 per cent. more was available for scutching. The increase in the seed and straw yields ranged from 4 to 6 per cent.

The most troublesome disease of linseed is that caused by *Septoria linicola* [*Sphaerella linorum*], preliminary tests on the control of which with a few hundred grammes of a mercury dust in 1941 gave encouraging results. Steam is an effective 'binder' of the fungicide to the seed, but its use requires great care owing to the difficulty of securing a uniform rate of application; the irregularities attendant on errors in dosage may be responsible for severe set-backs to germination in the field.

An experiment in linseed treatment in 1940 resulted in an increased seed yield of 17 per cent. in the lots dusted with tillantin 1875 at the rate of 200 gm. per 100 kg., which also raised germinative capacity to 132 (taking 100 as the index for the controls), the corresponding figures for the 100 and 400 gm. doses being 122 and 158, respectively.

A number of tests were carried out in which larger doses of the dusts (800 and 1,600 gm. per 100 kg.) were applied for the control of *P. lini* and *S. linorum*. The fungicidal action of the plant-protectives rose as the quantities were increased, but a very adverse influence was exerted on germination and growth. Such treatments would obviously be impracticable for commercial purposes, but might be appropriate for the disinfection of valuable material for use as progenitors in breeding.

BRIERLEY (P.) & McWHORTER (F. P.). **Diseases of garden Lilies.**—*Gdnrs' Chron. Amer.*, xlvii, 7, pp. 176–177, 184, 3 figs., 1943.

A short, popular account is given of the symptoms, cause, and control of lily blight (*Botrytis*) [*elliptica*: *R.A.M.*, xv, p. 507; xx, p. 19], *Fusarium* bulb rot [ibid., xv, p. 507], and mosaic [ibid., xx, p. 207]. According to E. P. Imle (American Lily Yearb., pp. 30–41, 1942), *Lilium hansoni, L. sargentiae,* and *L. maximowiczii* are highly resistant to *Fusarium* bulb rot. The authors state that *L. hansoni* and *L. pardalinum* are resistant to mosaic.

HAWKER (LILIAN E.). **Experiments on the rate of spread of Narcissus stripe in the field.**—*Ann. appl. Biol.*, xxx, 2, pp. 184–185, 1943.

In preliminary tests initiated by P. H. Gregory at Slough, in which rows of *Narcissus* plants with symptoms of stripe disease [*R.A.M.*, xxii, p. 359] were alternated with rows of healthy ones, no spread of disease was observed after five years. In the author's own experiments, commenced in 1933 at Slough, six lots of striped bulbs were planted in rows alternating with those of sound bulbs, the distance between rows being 12 in. and between adjacent bulbs in the same row 6 in. Of these six lots, five showed no spread of the disease in the fifth season after planting. Four of these showed a slight spread, from row to row and within the same row, during the following three years, the transmission taking place, with one exception, within the same row. It is suggested that this spread may have been due to the entanglement of roots of healthy and diseased plants. The sixth lot of plants had been moved to a fresh plot at the end of the first growing season, and this lot showed an increase in the number of diseased plants the following year, suggesting, as in McWhorter's experiment [ibid., xi, p. 579], that infection might have spread through roots damaged in lifting. In two tests where the distance between rows was 9 or 6 in. and that between adjacent plants 4 in., some spread, both from row to row and within a row, occurred during the first five years, particularly in the lot with the closest spacing. The control bulbs planted at some distance from diseased ones all remained free from infection. In an experiment with a few severely infected bulbs interplanted with sound stocks, disease spread from diseased to sound plants, while the sound stocks planted at a distance as controls remained unaffected. The results of these tests indicate that root transmission takes place when diseased and healthy plants are inter-planted. The amount of spread appears to be correlated with the distance between diseased and healthy bulbs. The small amount of infection of plants near to diseased ones does not, in the author's view, suggest transmission by insects above ground, but transmission may possibly take place through roots or bulbs damaged by insects in the soil, particularly where roots of diseased and healthy plants are closely interwoven.

OLIVE (L. S.). **Morphology, cytology, and parasitism of Thekopsora hydrangeae.**—*J. Elisha Mitchell sci. Soc.*, lix, 1, pp. 45–67, 8 pl., 1943.

Thekopsora hydrangeae is stated to occur abundantly in the mountains of North Carolina on *Tsuga canadensis* and, in its uredo and teleuto phases, on *Hydrangea arborescens, H. radiata,* and *H. cinerea. Thekopsora vacciniorum* was found sparingly on *Tsuga canadensis*; its alternate hosts were *Azalea viscosa* var. *montana, A. arborescens, A. calendulacea,* and *Cyanococcus similatus,* the last three being reported for the first time among the hosts of this rust. *Melampsora abieti-canadensis* occurred frequently on twigs and leaves of *T. canadensis*.

The first external sign of *Thekopsora hydrangeae* on *Tsuga canadensis* is the appearance of numerous inconspicuous, small pycnidia on the under and, to a lesser degree, upper surface of leaves, oozing out a sticky secretion containing the pycnospores. Aecidia appear as yellow, dome-shaped protrusions on the lower

surface of the leaf; the long, delicate peridia are quite conspicuous. Uredosori appear later in the season as numerous small, bright orange-coloured spots on the lower surface of *Hydrangea* leaves, uredospores continuing to re-infect the plant until the latter part of October. The teleutosori are quite inconspicuous; teleutospores overwinter on fallen *Hydrangea* leaves, and in the spring, when the leaves are moistened, basidia appear abundantly. Characteristic of this rust are the numerous subcuticular hyphae. Haustoria in the leaves of *Tsuga canadensis* are elongate and lobed uninucleate structures with an affinity for starch grains.

SLATENSEK (J. M.) & HOLLOWELL (E. A.). **Growth relationships as affecting root rotting and premature death of Sweet Clover.**—*J. Amer. Soc. Agron.*, xxxv, 6, pp. 523–531, 3 figs., 1 graph, 1943.

A severe root and crown rot, occurring each year since 1938 in the breeding nurseries for sweet clover (*Melilotus suaveolens*, *M. alba*, and *M. officinalis*) at the Nebraska Agricultural Experiment Station and causing an annual mortality among second-year plants of 60 per cent., was found to be due to excessive first-year growth. The restriction of such luxuriant development by means of close spacing, late sowing, and removal of top growth to reduce the photosynthetic area resulted in freedom from the disease, which assumed a virulent character, on the other hand, in widely spaced plants allowed to reach a size corresponding to that of regular nursery-grown plants. In 1941–2 a completely healthy second-year nursery was secured by starting the widely spaced (3 by 3 ft.) plants in late spring and transplanting in late June and early July. The aerial symptoms of the root rot appear mainly in the spring of the second year of growth and consist of partial or total wilting and yellowing, usually followed by death. The diseased roots are overgrown, soft, containing necrotic areas of varying extent, and consist of more and larger cells than those of healthy plants, the cell walls of the former being also abnormally thin.

JONES (F. R.). **Growth and decay of the transient (noncambial) roots of Alfalfa.**—*J. Amer. Soc. Agron.*, xxxv, 7, pp. 625–634, 1 fig., 1 diag., 1943.

Lucerne rootlets at the Wisconsin Agricultural Experiment Station have been observed to die off during the summer, following a browning and shrinkage of the primary cortex, in which the mycorrhizal fungus previously described [*R.A.M.*, iv, p. 301] may or may not be present, accompanied by a soft decay of the ends of the rootlets. The pathogenicity of the species of *Fusarium* isolated from such material has not yet been determined. The process of deterioration begins in late May or early June and increases rapidly from the middle to the end of the latter month. In severe cases the development of rootlets in July and August appears to be largely inhibited by the rotting of the ends almost immediately on emergence, and it seems possible that the early decay of transient roots limits to some extent the growth of the second crop.

WEIHING (R. M.) & ROBERTSON (D. W.). **The comparative performance of Alfalfa varieties in nursery and field plots in irrigated soil infected with Phytomonas insidiosa.**—*J. Amer. Soc. Agron.*, xxxv, 2, pp. 125–136, 1943.

As a result of the tests reported in full in this paper, the authors recommend for forecasting yield and other agronomic properties of lucerne, grown under irrigation in soil infested with *Phytomonas insidiosa* [*Corynebacterium insidiosum*] in Colorado, five-row plots with rows 12 in. apart and 20 in. alleys, the middle or the three central rows only being rated.

SPRAGUE (R.). **The status of Septoria alopecuri and some related species.**—*Mycologia*, xxxv, 3, pp. 259–263, 1 fig., 1943.

Discussing the status of *Septoria alopecuri* (Karst.) Sydow, originally listed by

Karsten (1884) as *S. bromi* var. *alopecuri* on *Alopecurus pratensis* from Finland, the author states that no type material is available but suggests that Karsten's fungus was more likely an undeveloped *Hendersonia*. Sydow's specimen is close to H. *crastophila* but it has narrower spores than most collections of the species.

A collection of *S. andropogonis* on living leaves of *Andropogon furcatus* from Kansas is described as a new form of this species, f. *sporobolicola*. It differs from the species in having larger pycnidia and smaller, more or less circular, non-striate lesions.

A fungus on living leaves of *Muhlenbergia mexicana* from Minnesota is described as *S. mississippiensis* n.sp. It is possibly close to Karsten's fungus, but not to *H. crastophila*.

HARDISON (J. R.) & SPRAGUE (R.). **A leaf spot of grasses caused by a new species of Phleospora.**—*Mycologia*, xxxv, 2, pp. 185–188, 2 figs., 1943.

Latin and English descriptions are given of *Phleospora graminearum* Sprague & Hardison n.sp., found in Michigan in 1941, causing a leaf spot of *Agropyron repens* and *Elymus canadensis*. Infection was very light on the latter, and was confined to the leaf blades, whereas on the former host it was heavy on the leaf blades and in some cases affected the leaf sheaths.

The fungus, which produced variable, elongate, brown spots paler in the centre, with margins sometimes yellow or buff-coloured, is characterized by subgregarious pycnidia, at first immersed, non-ostiolate, brown, later erumpent, prominent, with a small ostiole, subglobose, 90 to 160 μ in diameter, and pale brown; the upper layer breaks away, and the context is translucent and golden; the blunt, short, hyaline pycnophores are 3 to 5 μ wide, and the yellow-hyaline, obclavate, 1- to 6-septate pycnospores taper to a blunt point, are rounded or blunt at the base, variable, and measure 30 to 55 by 3·3 to 5·6 μ.

STRUBLE (F. B.). **Plot technique for disease-control studies on fine turf.**—*Phytopathology*, xxxiii, 6, pp. 528–530, 1 fig., 1943.

After pointing out that investigations on the chemical control of fine turf diseases on golf courses are hampered by the difficulty of finding sufficient area to minimize the error introduced by apportioning the small amount of necessary chemicals, the author describes a technique which obviates this difficulty. An area of 1,000 sq. ft. is allowed for each treatment and the required area for all the treatments marked out. The individual plots for the separate treatments are similarly marked off, and treatment is applied to both the rough and the green. For dollar spot [*Sclerotinia homoeocarpa*: *R.A.M.*, xvi, p. 681] data are obtained by arbitrarily selecting specific stations on a diagonal of each plot. The area of each station is that of a wire hoop 3 ft. in diameter and the spots per station are counted and averaged. For large brown patch [*Rhizoctonia* spp., chiefly *Corticium solani*: ibid., xvi, p. 468] and the 'melting-out' complex [*Helminthosporium* and *Colletotrichum* spp.] a rating system should be arranged, using the number of patches per ft. of diagonal.

LANGDON (R. F.). **Ergot of native grasses in Queensland.**—*Proc. roy. Soc. Qd*, liv, 3, pp. 23–32, 1942.

For the reliable determination of species of *Claviceps* the observation of the stromata produced by sclerotial germination is essential. In laboratory experiments with the sclerotia of six hosts of *C. pusilla* in Queensland [*R.A.M.*, xxi, p. 82], the same sequence of stages in the development of the stromata was found to occur constantly, and a comparable degree of uniformity characterizes other species of the genus, so that the mode of sclerotial germination may be used with advantage, in conjunction with the appearance of the stromata, in the diagnosis of *C.* spp. The most consistent features of the stromata in these studies were the

colour of the stipes and capitula, the presence or absence of loose hyphae, and perithecial size and shape; ascus length, on the other hand, varied within fairly wide limits. Conidial characters may be of use in the identification of species already described. A determination made on the basis of conidial and sclerotial morphology affords a valuable guide in the planning of inoculation experiments in which known ergot species are to be used as inoculum for a host bearing an ergot requiring determination, since positive results following infection with a given species would leave little doubt as to the identity of the fungus on the new host. This method was, in fact, of great service in a series of inoculation experiments with *C. pusilla,* the host range of which was found to comprise 12 indigenous grasses. This species of ergot is distributed throughout south-eastern Queensland, and was further identified on a sample of *Bothrichloa* sp. from New South Wales. The ascus length in the Queensland material of *C. pusilla* examined was found considerably to exceed Cesati's figure of 56 μ, which it is suggested should be replaced by a range of 55–160 μ.

Technical diagnoses are given of four new *C.* spp. collected in various parts of Queensland during 1941, namely, *C. annulata* on *Eulalia fulva, C. platytricha* on *Ischaemum australe, C. hirtella* on *Eriochloa pseudoacrotricha,* and *C. glabra* on *Digitaria longiflora.* The taxonomic positions of *C. paspali* on *Paspalum orbiculare* and of the ergots on *Hyparrhenia filipendula* and *Paspalidium* spp. are discussed.

PHILLIPS (W. R.) & JOHNSTON (F. B.). **The effect of boron applications on the subsequent storage and physiological behaviour of McIntosh Apples.**—*Sci. Agric.*, xxiii, 8, pp. 451–460, 4 graphs, 1943.

In studies on the effect of boron applications on the storage and physiological behaviour of McIntosh apples [*R.A.M.*, xxii, p. 362], observations before harvest showed that the treated plots appeared less mature than the untreated, but maturity data indicated that the treatments did not greatly reduce maturity progress. The results showed that the boron applications greatly increased core flush, or, conversely, the absence of boron resulted in core flush reduction. Where core flush was present, increasing the storage temperature to 39° F. significantly reduced it. The corky core indices were not consistently influenced by storage temperature. There was a close correlation between amounts of boron and core flush, and a converse relationship between core flush and corky core totals.

In 1939, fruit was harvested from the boron plots on 16th September and about a week later. At the first picking, all the samples were immature. At the second, there was marked advance in ground colour and starch reduction, no great difference being noted between the controls and treated plots. All the samples were stored at 32°, and re-examined on 26th February. The second picking was then of much better quality than the first. The controls were better than the treated apples in both pickings. The core-flush index in the controls was reduced from 21·1 to 3·9 between the two pickings, and in the treated plots from 81·3 to 58·4.

The mean corky core indices for the apples from the boron-treated plots were 66·1, and 61·5 for the first and second pickings, respectively, while the fruit from the plots with no corky core (which would possibly be higher in boron content) showed core flush indices from 111·6 and 52 for the first and second pickings, respectively.

From a practical point of view, the most important conclusion is that boron applications delay the maturing of McIntosh apples. Retarding picking from treated trees would appreciably assist in controlling core flush in storage.

BOYNTON (D.). **Magnesium deficiency—a newly recognized orchard trouble.**—*Fm Res.*, ix, 2, p. 2, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 13, p. 3870, 1943.]

The application to the soil surface of large quantities of magnesium sulphate in

the form of the German product, Emjeo, and as Epsom salts, gave partial control of leaf blotch associated with magnesium deficiency in mature McIntosh apple trees after three years, the effect of the compound being somewhat improved by an admixture of calcium hydroxide. Injections of dilute solutions of Epsom salts into the wood of affected branches controlled the disease during the season of application, but the beneficial effects did not persist, and small overdoses tended to cause fairly severe damage to the leaves. The symptoms of magnesium deficiency did not develop on the foliage of moderately affected trees sprayed four times during the summer with a solution of Epsom salts.

HOCKEY (J. F.). **Mosaic, false sting, and flat limb of Apple.**—*Sci. Agric.*, xxiii, 11, pp. 633–646, 11 figs., 1943.

A study of mosaic, false sting, and flat limb diseases of apple [*R.A.M.*, xx, p. 264] was conducted in Nova Scotia during 1937. Mosaic, which is stated to cause a very conspicuous, irregular, light yellowish to cream mottling of the foliage, followed later in the season by a necrosis of the light areas and thus a partial defoliation of the trees, was experimentally transmitted by grafting, but not by expressed juice or aphids. Limited data indicated a slight reduction in yield from affected trees.

The symptoms of false sting, believed to be a virus disease, are restricted to fruits, on which there appear depressed areas, sometimes with slight cracks and russeted streaks in the depressions; in the more pointed varieties, the calyx end may be gnarled and misshapen. The affected fruits show, under the microscope, a distorted vascular pattern. The only known method of transmission of this disease is by grafting. Eradication and careful selection of grafting material are recommended as control measures for both mosaic and false sting.

Flat limb is characterized by a flattening of the wood of the branches; this becomes very pronounced as the branches get older and is followed by a twisting and deformation of the branch. It occurs mainly on Gravenstein, but a very similar condition has been observed on Wagener. All available evidence indicates a stock-scion incompatibility as the initial cause of this condition.

BRITTON (J. E.), FISHER (D. V.), & PALMER (R. C.). **The influence of some horticultural practices on bitter pit in Okanagan-grown Apples.**—*Sci. Agric.*, xxiii, 11, pp. 651–675, 6 figs., 1943.

Bitter pit of apples [*R.A.M.*, xxii, p. 255] is stated to have been causing severe losses in British Columbia over a period of several years; exceptionally heavy losses are reported from the southern Okanagan valley in 1937. Replies to a questionnaire from 14 districts showed that bitter pit attacks many varieties, but particularly high losses are caused in Cox's Orange, Northern Spy, and Newtown. Losses incurred by the first two varieties amount to 55 per cent. in some orchards, while Newtown, though attacked less severely in individual orchards than the other two, suffers comparatively great total losses, being planted very extensively.

Experiments were conducted with Cox's Orange and Northern Spy apples over a two-year period, 1938–9, and with Newtown over one of five years, 1938–42, involving altogether 1,000 bush. boxes of apples from over 100 trees located in ten different orchards. It was found that fruit from trees carrying less than a third of a normal full crop is much more susceptible to bitter pit than fruit from trees carrying more than a third. Losses from bitter pit were materially reduced, but not entirely prevented, by packing the fruit at the proper stage of maturity, as indicated by maturity tests. Prompt storage at 32° F. delayed and to some extent reduced the development of bitter pit.

Careful comparison made of weather conditions which prevailed at the Summerland Experimental Station from 1939 to 1942, revealed that during the first

two years, when bitter pit was severe in Newtown apples, there was more than the average amount of sunshine in August and September and for the period April to October, inclusive, while in the following two years, in which bitter pit was slight, sunshine for the same period was significantly below average. Furthermore, rainfall during the growing season was markedly lower in the first two years. On the other hand, weather conditions in 1941 were very different from those in 1942 indicating the complexity of the problem. It is suggested that accurate records over a longer period of years need to be made before the connexion between bitter pit and weather could be assessed. With regard to control, it appears desirable to segregate the fruit from light and heavy crop trees. Grading for size or colour at the packing stage does not, in the authors' opinion, guarantee a complete segregation, which is better carried out in the orchard at harvesting time, by picking fruit from trees carrying less than a third of a normal crop separately from the main tonnage.

Butler (C. G.), Finney (D. J.), & Schiele (P.). **Experiments on the poisoning of Honeybees by insecticidal and fungicidal sprays used in orchards.**—*Ann. appl. Biol.*, xxx, 2, pp. 143–150, 2 diags., 1943.

Since the introduction of extensive spraying of fruit trees, complaints of losses of honey-bees from spray poisoning are stated to have been increasingly frequent [*R.A.M.*, xxii, p. 140]. No cases of poisoning by orchard sprays other than by those containing arsenic, in the form of calcium or lead arsenate, have been reported. Preliminary laboratory tests indicated that of the common constituents of spray mixtures, only lead arsenate and flowers of sulphur were likely to cause severe poisoning. The results of experiments conducted during 1940 to 1942 showed, however, that provided bees have alternative sources of water, pollen, and nectar, the addition to spray mixtures of 1 per cent. or stronger lime-sulphur or 0·05 per cent. or stronger nicotine sulphate is sufficient to repel the great majority of bees from sprayed trees and thus to reduce the risk of arsenical poisoning. When open flowers of apple trees were sprayed with various sprays in the orchard, counts of bees showed that the above-mentioned two substances had retained their repellent value for at least seven days.

Burkholder (C. L.). **Plum spraying problems.**—*Hoosier Hort.*, xxv, 4, pp. 52–54, 1943.

In connexion with recommendations for certain necessary adjustments in the spraying schedule for plums in abnormally wet seasons, such as 1942, in Indiana, some notes are given on varietal reaction to brown rot [*Sclerotinia fructicola*]. The damson group, especially French and Shropshire, rarely need more than two lime-sulphur sprays during July and August to protect them against infection, very little of which will occur in dry seasons even without treatment. Other varieties resistant to brown rot are Fellenburg or Italian Prune (which is, however, very susceptible to leaf spot), Diamond, and Stanley. On the other hand, *S. fructicola* occurs in a highly virulent form on Lombard, Burbank, Imperial Epineuse, Gulii, Monarch, Austrian and Hungarian Prune, Yellow Egg, Grand Duke, Reine Claude, and Albion, the three last-named late-ripening varieties requiring a supplementary sulphur spray in September. The same three varieties are very resistant to leaf spot.

Simonds (A. O.) & Bodine (E. W.). **A macrochemical reaction for the detection of Peach mosaic.**—*Science*, N.S., xcvii, 2530, pp. 587–588, 1943.

In experiments with the Elberta peach variety in Colorado, the colour reactions obtained with the xylem of sections of roots and stems of trees infected with the severe and medium strains of the peach mosaic virus [*R.A.M.*, xxi, p. 338] ranged from Ridgway's maize-yellow to apricot-yellow, while healthy sections were

Persian lilac and daphne pink. The technique employed consisted in cutting thin, free-hand sections from diseased and healthy trees, placing first a drop of a saturated solution of phloroglucinol in 100 per cent. methyl alcohol on each section, and then, when that had evaporated, a drop of a solution of nitrophenolic acid, which in turn was allowed to evaporate. The solution of nitrophenolic acid was prepared by adding 50 ml. concentrated nitric acid to ½ gm. of C.P. phenol, leaving it to stand over-night; then mixing this with an equal volume of water the next day and again leaving it to stand for about 18 hours; and finally placing three drops of this solution in 25 ml. 100 per cent. methyl alcohol. The colour reactions were greatest on fresh material tested in the autumn or early spring.

WILSON (E. E.). **Tests of eradicant sprays for use against Sclerotinia laxa and Coryneum beijerinckii in Apricots and Almonds.**—*Phytopathology*, xxxiii, 6, pp. 506–516, 1 fig., 1 graph, 1943.

Of 41 materials tested for their ability to eradicate *Sclerotinia laxa* overwintering in blighted twigs and rotted fruits in apricot and almond trees, the only ones that showed promise were 0·5 and 0·3 per cent. solutions of sodium dinitro-ortho-cresylate (elgetol) and 1 per cent. solutions of sodium tetrachlorophenate, sodium pentachlorophenate, sodium ortho-phenolphenate, tetrachloropara-benzoquinone [spergon], and 4-chloro-1,2-benzoquinone dioxime. In extended trials, these materials displayed only moderate ability to prevent the development of the sporodochia on the twigs during winter, mainly because they failed to kill the mycelium within the twigs. After the sporodochia had developed, however, these materials were, under some conditions, moderately effective in destroying them. In orchard tests in 1942, no material reduced the primary inoculum sufficiently to lower the amount of blossom infection to any appreciable extent.

The sodium salts of dinitro-ortho-cresol and the two chlorophenols were about equally effective in killing the conidia of *Coryneum beijerinckii* [*Clasterosporium carpophilum*] in blighted dormant buds of apricot, peach, and almond. One week after applying 0·5 or 1 per cent. solutions of these materials to affected twigs, 80 to 95 per cent. of the conidia were dead. Many new conidia were, however, subsequently produced within the sprayed buds.

Unless these materials can be made more capable of penetrating the conidial masses and of entering the host tissues they are unlikely to prove successful as eradicant sprays against these two diseases.

KEITT (G. W.) & CLAYTON (C. N.). **A destructive virus disease of sour Cherry.**—*Phytopathology*, xxxiii, 6, pp. 449–468, 9 figs., 1943.

Studies carried out in Wisconsin from 1936 to 1940 on yellows of sour cherries [*R.A.M.*, xxii, p. 214] showed that affected trees tend to produce large leaves, some of which bear conspicuous chlorotic areas. The chlorotic leaves, together with some that remain green, are abscissed, severe defoliation generally occurring three or four weeks after petal-fall. The diseased trees seem to live almost as long as healthy ones, but they produce scanty crops.

Reciprocal budding experiments between affected and healthy trees resulted in transmission of the condition in every case in which union of tissues of bud piece and budded tree occurred. Transmission of the virus was also effected by budding from *Prunus cerasus* to *P. mahaleb* and back.

Records of incidence from 1936 to 1940, inclusive, in five orchards containing 2,593 trees, showed an average annual increase of 3 per cent. In 1940, the percentage of diseased trees in 18 orchards containing 6,588 trees was 10·7. Montmorency and Early Richmond appeared equally susceptible.

Preliminary tests strongly suggested that the disease can be transmitted by Cicadellidae. Further work is in progress.

ULMAN (P.). **Red stele disease of Strawberry.**—*Hoosier Hort.*, xxv, 4, pp. 51–52, 1943.

The symptoms of red stele disease of strawberry [*Phytophthora fragariae*], recently detected in Indiana [cf. *R.A.M.*, xxii, p. 363], are briefly described and growers are advised to adopt stringent measures for its exclusion from their plantations. Once established in a site, the pathogen will remain viable in the soil for at least five or six years, and in such cases the only solution lies in the cultivation of a resistant variety, such as Pathfinder. Field inspection and the rejection of diseased material for planting are greatly complicated by the absence of any external signs of infection under certain conditions both on dry and wet soils, the period during which a plant may act as a symptomless carrier of the fungus being as yet unknown.

HARRIS (R. V.), BRYCE (A. D.), & FOISTER (C. E.). **Raspberry leaf curl.**—*Fruit-grower*, xcvi, 2483, p. 51, 1 fig., 1943.

Attention is drawn to the occurrence of serious and widespread outbreaks of leaf curl in Norfolk Giant raspberry plantations in Angus and Perthshire, and growers are advised to adopt the following precautionary measures: (1) immediate removal and burning of every diseased or suspected stool; (2) exclusive use of healthy canes for new plantings of the affected variety; and (3) isolation of Norfolk Giant plantings, especially those intended for cane propagation, from Lloyd George (believed to be a carrier of the disease), particularly in the case of stocks of the latter propagated in Scotland for some years. Leaf curl has not yet been observed on Norfolk Giant in English plantations, even on certain Scottish stocks of the variety.

BITANCOURT (A. A.). **Podridões da Castanha do Pará.** [The rots of the Pará Chestnut.]—*Biológico*, vii, 11, pp. 303–312, 1 fig., 1941. [English summary. Received August, 1943.]

Towards the end of 1938 the author received from a commercial firm at Manaos, in the State of Amazonas, Brazil, two consignments of Pará chestnuts (*Bertholletia excelsa*), known to the trade as 'Brazil nuts', the contents of which were divided into three lots (1) being immediately opened, (2) kept for five months in a damp refrigerator at 5° to 6·5° C., and (3) for the same period in a well-ventilated room. During the period covered by the experiments a thermo-hygrograph registered a temperature of 16° to 29° and a humidity of 34 to 88 per cent. in the city of São Paulo.

The three series were found to contain the following percentages of rancid and rotten nuts: (1) 4 and 6, respectively, (2) 6 and 22, and (3) 4 and 5. In lot (1) *Aspergillus flavus* was isolated from over 50 per cent. of the rotten and rancid material under examination, other species represented being *A. luteo-virescens*, *A. wentii*, *A. ochraceus*, *Monilia sitophila* (probably an accidental laboratory contaminant), *Penicillium phoenicum*, *Rhizopus nigricans* [*R. stolonifer*], a species of *Diplodia*, probably *D. natalensis*, with which *Pellionella macrospora* Spencer [*R.A.M.*, i, p. 235] is regarded as identical, a species of *Phomopsis*, assumed to be that referred by Spencer to *P. bertholletianum* [loc. cit.] and falling in the group having *Diaporthe medusae* as its perfect stage, *Colletotrichum gloeosporioides*, and *Cephalosporium bertholletianum* Spencer [loc. cit.]. The organism predominating in series (2) was a species of *Penicillium*, probably *P. citricola*, which also occurred in (3) together with an *Aspergillus* of the *albus* group and *R. stolonifer*. Dr. C. Thom, of the United States Department of Agriculture, undertook the identification of the *Aspergillus* and *Penicillium* spp. in connexion with this inquiry.

It is evident from these results that humidity is the controlling factor in the health of stored Brazil nuts, which keep well in properly ventilated rooms even

at relatively high temperatures. Where ventilation is inadequate to reduce the atmospheric humidity to a suitable level, the installation of a small refrigerator to condense the moisture of the storage rooms is recommended.

HORSFALL (J. G.). **A conference on spray material shortage.**—*Chron. bot.*, vii, 7, pp. 338–339, 1943.

An informal conference under the chairmanship of Dr. C. I. Bliss held on 14th February, 1943, at Columbus, Ohio, to discuss the possibilities of effecting economies in spray materials during war-time disclosed the fact that the multidose method enables the experimenter to determine quantitatively how much of a given material can be saved by modifications in technique. The slope of the dosage response relation shows how far dosage can be reduced without serious risk. The evidence so far indicates that reduction in concentration is the most effective means of economizing, reducing control, as it does, less rapidly than does reducing the number of gallons applied per acre. Reduction in the number of applications must also be seriously considered, as it saves labour. It might be useful in vegetable spraying, where time is less important than in fruit spraying.

WILSON (E. E.). **Physical characteristics of Bordeaux mixture in relation to its qualities.**—*Phytopathology*, xxxiii, 6, pp. 497–505, 1 fig., 2 graphs, 1943.

Studies on the weather resistance of Bordeaux mixtures varying in physical characteristics because of differences in the methods of combining the copper sulphate and lime showed that precipitate made by mixing diluted components settled more slowly and was more bulky than that made by mixing concentrated components (12 per cent.) and then diluting.

In three weathering tests on twigs of peach and apricot trees in winter, when rainfall totalled 3 to 4 in. Bordeaux mixture prepared with diluted components lost 18, 34, and 38 per cent. of the copper, while that prepared with concentrated components lost 65, 70, and 58 per cent.

Active and prolonged agitation improved the suspension quality of the concentrated type but did not appreciably affect its weathering quality. In two of three tests the mixture made with diluted constituents deposited significantly more copper than that made with concentrated ingredients.

GOLDSWORTHY (M. C.), GREEN (E. L.), & SMITH (M. A.). **Fungicidal and phytocidal properties of some metal dialkyl dithiocarbamates.**—*J. agric. Res.*, lxvi, 7, pp. 277–291, 1 graph, 1943.

Experiments made to determine the fungicidal and phytocidal properties of some metal dialkyl dithiocarbamates indicated that the dimethyl derivatives possess the greatest fungicidal value, and the dibutyl derivatives the least. The iron, lead, and zinc dimethyl derivatives offered the most promise, as they caused the least plant injury. From all standpoints the lead salts appear best.

Preliminary tests indicated that the iron, zinc, and lead derivatives can be made up in the spray tank by mixing stoichiometrical equivalents of the reacting salts. The product remains in suspension and has superior sticking qualities. Zinc and iron mixtures of this type caused slight injury to peach, but none caused any injury to apple.

All the metal dialkyl dithiocarbamates tested were compatible with hydrated lime and lead arsenate. Tests with the iron dimethyl dithiocarbamates indicated that this metal derivative retained its fungicidal efficiency when combined with bentonite or nicotine sulphate and bentonite, but not when combined with bentonite flocculated with lime.

In field tests against apple scab (*Venturia inaequalis*), a commercial sample of ferric dimethyl dithiocarbamate gave satisfactory results. It controlled peach

scab (*Cladosporium carpophilum*) and brown rot (*Sclerotinia fructicola*) without injury to the fruit, but it caused a leaf-spotting which became progressively greater as the material on the leaves aged. It produced no ill effect on cherry, on which, however, it failed to control leaf spot (*Coccomyces hiemalis*).

HICKMAN (C. J.), MARSH (R. W.), & WILKINSON (E. H.). **Preliminary experiments on the use of oil-soluble copper compounds as fungicides.**—*Ann. appl. Biol.*, xxx, 2, pp. 179–183, 1943.

A selection of oil-copper mixtures was examined for solubility and stability, and the fungicidal and phytocidal properties of the more promising combinations tested in the laboratory during 1942 on conidia of *Macrosporium* [*Stemphylium*] *sarciniforme*, *Venturia pirina*, and a *Botrytis* sp. from onion foliage. It was found that turpentine, 'palustrex' pine oil, and white spirit were injurious to onion foliage, whereas cottonseed oil and white oil were harmless. Copper salts dissolved in white oil, white spirit, turpentine, or pine oil had a higher fungicidal value than those dissolved in cottonseed oil. A solution of copper 3 : 5-di-*iso*propyl salicylate in oil was consistently more fungicidal than Bordeaux mixture of the same copper concentration. It is suggested that further investigation will probably disclose the existence of more such oil-soluble copper compounds of high toxicity. In small-scale field trials against onion mildew (*Peronospora schleideniana*) [*P. destructor*], copper 3 : 5-di-*iso*propyl salicylate, dissolved in white oil to a concentration equivalent to 0·01 per cent. copper by weight, was not phytocidal when atomized three times at monthly intervals on to the onion foliage, while the higher concentration (0·1 per cent.) of the same material was markedly injurious. The material failed to control mildew. The method of atomizing was found to be convenient for small-scale work; it gave perfect wetting of the foliage and was most economical of material.

PARKER-RHODES (A. F.). **Studies in the mechanism of fungicidal action. V. Non-metallic and sodium dithiocarbamic acid derivatives.**—*Ann. appl. Biol.*, xxx, 2, pp. 170–179, 4 graphs, 1943.

In continued studies on the fungicidal action of various chemicals [*R.A.M.*, xxii, p. 101], the author investigated, with the help of the theory of variability, the fungicidal possibilities of 13 derivatives of dithiocarbamates and thiuram sulphides [ibid, xxii, p. 364], all compounds prepared for use in the processing of rubber and thus readily available. *Macrosporium* [*Stemphylium*] *sarciniforme* was used as the test organism. From the results obtained in toxicity tests it is inferred that: (*a*) dithiocarbamates are decomposed by the spores to a greater or lesser degree into amine and carbon disulphide, both being toxic; (*b*) the amines can be absorbed only in a combined form, which may be the dithiocarbamate itself but is more probably a derivative, possibly an ester; (*c*) the carbon disulphide probably acts through the mediation of a thiocarbonate; and (*d*) thiuram sulphides act through being decomposed to dithiocarbamates (or their derivatives mentioned above). The monosulphides were largely, and the disulphides slightly, decomposed, in the latter case with reduction. The methyl derivatives of dithiocarbamic acid were by far more toxic than any others tested, and, at least with regard to the test fungus, are the only ones to show any promise of practical usefulness. Their greater toxicity is attributed to the shortness of the hydrocarbon chain. It is concluded that the role of the carbon disulphide is chiefly that of a chemical carrier of the amino group, but that, owing to the negative index of variation of the spores to the latter, the carbon disulphide is essential for completing the toxicity. Work is in progress on the fungicidal action of heavy-metal salts of the dithiocarbamic acids.

Martin (H.). **The evaluation of fungicides. Addendum.**—*J. Soc. chem. Ind., Lond.*, lxii, 7, p. 112, 1943.

Notes on the chi-square test are furnished in response to requests by readers of the author's paper on the evaluation of fungicides [*R.A.M.*, xxii, p. 320].

Ekstrand (H.). **Spridningsmedel för besprutningsvätskor.** [Spreaders for spray solutions.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 2, pp. 3–4, 1943.

Tables are given showing the results of experiments to determine the relative merits of a number of fungicidal solutions and spreaders, which were graded through a scale of 0 to 5, the latter figure denoting sufficient coverage of the sprayed surface and the former complete inadequacy of dispersal. The most effective of the fungicides tested was an oil emulsion known as 'jofurolja' (3 per cent.) and a 'special' form of the same preparation (2 per cent.), both allotted the grade of 5, good results (4·5) also being obtained with these two at a strength of 1 per cent. The grades of four other fungicides, viz., Ob 2300 (1 per cent.), Cu 35 (0·25 per cent.), lime-sulphur (3 in 100), and 1 per cent. Bordeaux were raised from 0·5 to 4 and 4·5 by the admixture of T.A. at the rate of 0·05 and 0·1 per cent., respectively, and to 3·5 and 4 to 4·5 by T.B. at 0·5 and 1 per cent., respectively, while the maximum increase with skim milk (10 per cent.) only brought Ob 2300 up to 2·5.

Whittaker (E. C.). **The care and maintenance of orchard machinery and equipment.**—*Agric. Gaz. N.S.W.*, liv, 3, pp. 114–115, 1 fig., 1943.

Brief practical directions are given for the care and maintenance of spraying appliances and packing shed equipment, both of which are liable to be neglected. Appliances need proper lubrication, protection of the pump and engine against grit, and when not in use during the summer the vat should be kept full of water. Flushing the apparatus with clean water after use and proper renovation at the end of the season are stressed.

Bisby (G. R.). **Geographical distribution of fungi.**—*Bot. Rev.*, ix, 7, pp. 466–482, 1943.

From a study of the geographical distribution of fungi [*R.A.M.*, xii, p. 579] the author concludes that species of phanerogams acceptable to-day outnumber such species of fungi by about five to one. There are, perhaps, three times as many phanerogams as fungi. In spite of this, species of fungi probably outnumber species of phanerogams in any particular state or country, and the smaller the area, the greater the preponderance of fungi. The geographical distribution of fungi is primarily controlled by that of the hosts and substrata. As a parasite is usually able to attack more than one host species, its geographical range will probably be greater than that of any one of its hosts. Other factors influencing fungal distribution are climate, which is often important, nature and density of phanerogams, light, and human activities.

Bitancourt (A. A.). **Plant pathology in Brazil.**—*Chron. bot.*, vii, 7, pp. 318–320, 1943.

After touching on the early history of plant disease research in Brazil, where a Laboratory of Plant Pathology was founded by the Federal Government in 1910 under A. Puttemans, the Instituto Biológico de Defesa Agricóla in 1920, and the Instituto Biológico de São Paulo (where the staff now exceeds 600) in 1928, the author mentions the facilities for studying plant pathology that exist in the country to-day, and states that the science has developed rapidly in Brazil during the past ten years. Delay in the introduction of modern methods of disease control has largely been due to the fact that Brazil's two chief crops, coffee and cotton, are

comparatively free from disease, but the rapid development of citrus-growing since 1930 has necessitated up-to-date methods of disease control in this crop. The paper concludes with a discussion of the problem of plant quarantine.

MACARA (T. J. R.). **Dried meat. II. The growth of moulds on dried meat.**—*J. Soc. chem. Ind., Lond.*, lxii, 7, pp. 104–106, 1943.

At the Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge, the writer investigated the conditions of temperature, relative humidity, and water content permitting the growth of moulds (*Penicillium* and *Aspergillus* spp.) on air-dried, pre-cooked meat of standard quality [cf. *R.A.M.*, xiii, p. 442]. The minimum humidity at which mould development occurs was found to be very slightly below 75 per cent., corresponding to a water content of 10 per cent. in dried meat containing 40 per cent. fat. This minimum value does not vary appreciably within a temperature range of 20° and 37° C. The incidence of infection in some experimental samples from overseas accorded with the laboratory data.

YARWOOD (C. E.). **Association of thrips with powdery mildews.**—*Mycologia*, xxxv, 2, pp. 189–191, 1943.

Thrips tabaci was observed in different localities in California in association with *Uncinula necator* on vine, *Sphaerotheca pannosa* on rose, *S. humuli* on strawberry, *Erysiphe cichoracearum* on cantaloupe, and *E. polygoni* on clover and *Oenothera* sp. In dish cultures, thrips transferred to mildewed vine and rose leaves throve better than those on healthy leaves. The insects appeared to feed on and destroy established mildew colonies on rose and vine leaves, but appeared to be of no economic importance.

CUNNINGHAM (I. J.). **The sclerotia of Sclerotinia sclerotiorum (Lib.) Mass. are not poisonous.**—*N.Z.J. Agric.*, lxvi, 6, p. 372, 1943.

When several pounds of the sclerotia of *Sclerotinia sclerotiorum* were fed to six rats (for 11 weeks) and a pig (for 5 days), no harmful effects ensued, and it is concluded that the sclerotia of this fungus are not poisonous to such animals.

ARMITAGE (F. D.). **II.—Further uses for chlorazol black E and a new stain for botanical sections.**—*J. R. micr. Soc.*, Ser. iii, lxiii, 1–2, pp. 14–19, 2 pl., 1943.

Chlorazol black E is recommended as a histological stain for the microfungi, and as particularly useful for photomicrographic purposes. The author obtained good results also with the following mixture: two parts by weight each of phenol crystals, lactic acid, and water, mixed with one part of pure glycerine, and sufficient chlorazol black E added to give the mixture the appearance of Indian ink. Supplies of chlorazol black E can be obtained from British Drug Houses, Ltd.

MCCREADY (R. M.), OWENS (H. S.), & MACLAY (W. D.). **The use of fibrous sodium pectate as a substitute for agar in bacteriological gels.**—*Science*, N.S., xcvii, 2523, p. 428, 1943.

As a substitute for agar in the pure culture of bacteria very satisfactory results have been secured at the Western Regional Research Laboratory, United States Department of Agriculture, Albany, California, with fibrous sodium pectate, the preparation and properties of which have been described by Baier and Wilson (*Industr. Engng Chem.*, xxxiii, p. 287, 1941). The medium is purchasable on the market (California Fruit Growers' Exchange, Ontario, California), but purification is advisable by suspension in 60 per cent. alcohol, adjustment to P_H 7·5 with sodium hydroxide, filtration, and desiccation *in vacuo* at 60° C. Directions are given for the preparation of a nutrient gel by the addition of a 2·5 per cent. solution of fibrous pectate to a nutrient broth. The Northern Regional Research Laboratory, Illinois, also reports good results with moulds on the new substratum.

Stampa (G.). **Present state of the biological synthesis of fats and its industrial possibilities.**—*Int. Rev. Agric.*, xxxiii, 12, pp. 428T–435T, 1942.

In this paper the author discusses various aspects of the problem of using the carbohydrates in rejected fruits, canning industry trash, and many agricultural waste products to obtain fats by biological synthesis effected by fungi, particularly *Endomyces vernalis*, *Penicillium javanicum*, and *Oidium* [*Oospora*] *lactis* [cf. *R.A.M.*, xiv, p. 522].

Ainsworth (G. C.). **Virus nomenclature.**—*Ann. appl. Biol.*, xxx, 2, pp. 187–188, 1943.

The author considers that the development of an international nomenclature for viruses is work for the future, but that the standardization of the English names of virus diseases (from which common names for viruses can always be derived) would greatly facilitate the work of plant pathologists. He also urges that in compiling lists of synonyms a distinction should be made between 'obligate' synonyms (those based on the same type) and 'facultative' synonyms (based on different types) [*R.A.M.*, xxii, p. 176].

Holmes (F. O.). **A comment on Dr. Johnson's 'Virus Nomenclature and Committees'.**—*Chron. bot.*, vii, 5, pp. 201–202, 1942.

In these comments the author disagrees with some of Professor J. Johnson's opinions already noticed in this *Review* [*R.A.M.*, xxi, p. 343].

Robbins (W. J.), Kavanagh (Virgene W.), & Kavanagh (F.). **Growth substances and dormancy of spores of Phycomyces.**—*Bot. Gaz.*, civ, 2, pp. 224–242, 1 fig., 3 graphs, 1942.

The failure of spores of *Phycomyces blakesleeanus* to germinate on mineral-dextrose agar medium containing thiamin is interpreted as a dormancy phenomenon. The addition to the medium of extracts of potato tubers or other natural products of sodium acetate or the sodium salts or other organic acids increased germination to nearly 100 per cent. Treatment of spores with aqueous pyridin had the same favourable effect.

Ossiannilsson (F.). **Studier över de svenska Potatisfältens insektfauna och dess betydelse för spridning av virussjukdomar. I. Hemiptera, förekomst och utbredning.** [Studies on the insect fauna of the Swedish Potato field and its importance in the spread of virus diseases. I. Hemiptera, occurrence and distribution.]—*Medd. Växtskyddsanst., Stockh.*, 39, 72 pp., 9 figs., 5 diags., 4 maps, 1943. [German summary.]

Full particulars are given of the characteristics, biology, and geographical distribution in Sweden and elsewhere of *Myzus persicae*, *M. pseudosolani*, *Macrosiphum gei*, and *Aphis rhamni*, vectors of potato virus diseases, and of a number of other Hemiptera, the suspected connexion of which with potato viruses has not been conclusively established.

Lihnell (D.). **Om bladrullsjukans spridning i Potatisfälten.** [On the spread of leaf roll in the Potato field.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 2, pp. 6–11, 1 fig., 1 map, 1943.

An experiment is in progress in 32 localities throughout Sweden to determine the extent of the spread of potato leaf roll in the field, the results of which for 1941 are now available. At each place the tubers are planted out in five rows of ten tubers, of which the middle one is occupied by 100 per cent. diseased material and the two outer ones on either side by healthy seed of the susceptible Magnum Bonum and Ostergyllen varieties. Of the nine test areas in which a more or less

extensive spread of infection was recorded (all in low-lying or coastal districts of the south) [*R.A.M.*, vii, p. 596], Alnarp provided the highest figures with a total of 27 leaf-roll plants, 11 of Östergyllen and 16 of Magnum Bonum. More surprising is the occurrence of 12 infected plants (six of each variety) at Uppsala, where the Botanic Garden presumably harbours an abundance of aphid vectors, since environmental conditions are not otherwise propitious.

SHEFFIELD (F[RANCES] M. L.). **Value of phloem necrosis in the diagnosis of Potato leaf-roll.**—*Ann. appl. Biol.*, xxx, 2, pp. 131–136, 1 pl., 1943.

The examination during 1941 and 1942 of a number of potato varieties showed that a phloem obliteration and necrosis restricted to the primary phloem of bicollateral bundles, was present in all of 179 plants of 33 varieties showing secondary leaf roll [*R.A.M.*, xi, pp. 121, 741], but not in any of 83 healthy plants of 20 varieties. The necrotic cells stained with those reagents generally used to show lignified tissue, and also reacted with phloroglucinol. Necrosis was found always to occur before leaf-rolling set in, starting near the base of the main stem and spreading upwards. The amount of necrosis varied in different plants, but was in any one variety correlated with the severity of external symptoms. When these were severe, necrosis could be found in almost all parts of the plant, except the stolon, tubers, and roots; when mild, it was confined to one or two strands of primary phloem extending vertically to only two or three internodes. Necrosis may occur equally in the internal and external primary phloem, or it may be confined to one or may be severe in one and slight in the other. The number of affected strands is usually greatest at the nodes. In a few artificially infected plants with primary leaf roll infection, slight necrosis was found to develop, spreading upwards from the place of inoculation. It was not determined whether, as in secondary leaf roll, the necrosis is present before rolling occurs.

Comparison with some other abnormal plants yielded no evidence that any other pathogen or physiological condition can cause a necrosis confined to the primary phloem strands. It is therefore concluded that the type of necrosis described may be of practical value for detection of leaf roll. A technique suggested for the diagnosis of secondary leaf roll is outlined as follows: a piece is taken from near the base of a main stem extending from about 1 in. below soil-level to about above the sixth node above ground; it is trimmed off and sectioned into smaller pieces; these are cut by hand through the nodes and put into phloroglucinol solution (1 per cent. in 50 per cent. alcohol) on a slide for one minute, then the solution is drained off and replaced for one minute by 50 per cent. hydrochloric acid; this is in turn drained off, the section mounted in water and examined under the microscope at about × 100. In a healthy plant the xylem will appear purplish-red, while all other tissues will be colourless, except some of the phloem fibres, which may be pink or red. In a leaf roll-infected plant, on the other hand, some of the primary strands will be of a yellowish-red. It may be expected that if leaf roll is present phloem necrosis will be detected in some of the six nodes under examination. It is suggested that in examining an unfamiliar variety, a healthy stem and if possible also one known to be infected with leaf roll should be examined for comparison.

Scottish Society for Research in Plant Breeding. Report (abridged) by the Directors and Report of the Director of Research to the Annual General Meeting, 15th July, 1943.—33 pp., 1943.

The following items of interest occur in the Report of the Director of Research [cf. *R.A.M.*, xix, p. 723]. W. BLACK states that a large number of new potato seedlings in the early stages of trial have shown resistance to blight [*Phytophthora infestans*], immunity in the field from viruses A and X, and general promise of

fulfilling agricultural requirements, but no complete immunity from leaf roll has yet been found, though certain varieties have some resistance.

P. infestans does not appear to be completely stable, as a distinct, more virulent strain was isolated from it. Some varieties are immune from the original, A, strain used for testing varietal reaction, but succumb to strain B. Both strains were used in the 1942 tests with about 5,000 plants, and all the seedlings which were immune from strain B were also immune frrom strain A. Resistance to the two strains was found to be controlled by two dominant genes, Ra and Rb. A satisfactory proportion of the experimental material was resistant to both strains. This material included progenies bred from *S[olanum] tuberosum* varieties and a 48-chromosome hybrid derived from *S. rybinii* ($2n = 24$) and *S. demissum* ($2n = 72$). The fertility of these progenies in some cases reached 100 per cent.

G. Cockerham and C. H. Cadman state, *inter alia*, that an unrecorded but suspected virus has been located within wild potato material.

Gilmore (L. E.) & Robinson (C. H.). **Studies in seed Potato treatments. Testing and adjusting corrosive sublimate solutions I. Laboratory control method.**—*Sci. Agric.*, xxiii, 11, pp. 676–681, 1943.

The authors describe a simple laboratory test for checking the concentration of mercuric chloride solutions at the initial and successive seed potato treatments for the purpose of adjusting the solutions to the effective strength. It consists in titrating 100 ml. of the mercuric chloride solution intended for treatment (of a concentration of 1 : 1,000 or 0·5 : 1,000) together with a 0·2 per cent. starch solution against a standard test solution containing 5 gm. potassium iodide and 0·5 gm. copper sulphate pentahydrate ($CuSO_4.5H_2O$) per l., until a blue colour appears. The titration result is then referred to an adjustment table to obtain the amount of 5 per cent. mercuric chloride solution required to adjust the treatment solution to its full strength.

Gilmore (L. E.) & Robinson (C. H.). **Studies in seed Potato treatments. Testing and adjusting corrosive sublimate solutions II. Field control method.**—*Sci. Agric.*, xxiii, 11, pp. 682–687, 1943.

Deterioration of mercuric chloride solutions in the hands of inexperienced farmers is stated to have often made ineffective seed potato treatment against *Rhizoctonia* [*Corticium solani*], scab [*Actinomyces scabies*], and black leg [*Erwinia phytophthora*]. Instructions are given for the preparation of solutions, and users are warned of the deterioration produced by contact with metals. The actual treatment should be preceded by soaking the tubers five to six hours in clean water to remove soil and other vegetable matter.

A field control test, originally developed in 1935, is described for the adjustment of the strength of the treatment solutions. The procedure is essentially the same as used in the laboratory [see preceding abstract]: the blue liquid test mixture is added to the partially exhausted treatment solution in a 100 ml. graduate till the blue colour disappears. The graduate reading of the volume of the liquid is then referred to the adjustment table to obtain the amount of stock mercuric chloride solution necessary to adjust the solution to the effective strength.

Goss (R. W.) & Livingston (J. E.). **The influence of crop rotations on the occurrence of scab, Rhizoctonia, and Fusarium wilt in Potatoes under dry-land conditions in western Nebraska.**—*Rep. Neb. Potato Imp. Ass.* 22, pp. 22–27, 1941.

Records were taken on the incidence of scab [*Actinomyces scabies*], *Rhizoctonia* [*Corticium solani*], and Fusarium wilt [*F. solani* var. *eumartii*: *R.A.M.*, xxi, p. 39], the three chief soil-borne potato diseases in western Nebraska, on the Bliss Triumph variety in the $\frac{1}{10}$-acre rotation plots at the Box Butte Experiment Farm from

1931 to 1939, all the data being based on 100 lb. random samples from each plot. All three diseases were most severe in the years of heavy rainfall and correspondingly high yields, and least in evidence in the very dry seasons of 1934 and 1936. Cultivation in the same plot for two consecutive years led to a marked increase in the amount of scab and *C. solani*, and in 1932 the plot that had been under potatoes for three years in succession yielded only 51·8 per cent. sound tubers, compared with an average of 91·9 per cent. in the other plots. *Fusarium* wilt, on the other hand, did not increase during the first three consecutive years of potato cultivation, when the percentage of infection fluctuated between 2 and 5 per cent. Less than half as much scab and *C. solani* infection developed in the three-year rotation as in the continuous plots, and in six out of seven years the incidence of *F. solani* var. *eumartii* was also lower in the former than in the latter. From the standpoint of scab control there was no advantage in five- as against three-year rotations, and the differences in favour of the former for the other two diseases were not large enough to be significant. The nature of the preceding crop (maize, wheat, or summer fallow in the quinquennial, and maize, wheat, or beans in the triennial rotations) was less important than the duration of the period between two potato crops. These results are in marked contrast to those obtained in the irrigated areas of the State, where the type of the preceding crop exerts a decisive influence.

FOISTER (C. E.). **On the control of Potato skin spot disease.**—*Ann. appl. Biol.*, xxx, 2, pp. 186–187, 1943.

The skin spot disease of potato, caused by *Oospora pustulans* [*R.A.M.*, xix, p. 41], is stated to affect at times the potential sales value of tubers of certain varieties, such as King Edward, Majestic, Kerr's Pink, Arran Banner, and Sharpe's Express, and to cause a considerable amount of 'blindness', particularly in King Edward and Majestic, due to invasion of the eyes by the causal fungus. In experiments conducted in Scotland from 1941 to 1943, ware and seed of King Edward and Kerr's Pink potatoes were dipped for 1 minute in organo-mercurial solutions A and B prior to pitting. Examination of the tubers in the following spring showed that 87·65 to 98·51 per cent. of the tubers dipped in solution A and 90·60 to 97·90 per cent. of those dipped in B were free from disease, as against only 2·43 to 11·86 per cent. of the untreated control. The balance of the dipped lots fell entirely into the slightly affected group, while the untreated controls had some severely affected tubers. It was also shown that dipped tubers, when subsequently planted out, had a quicker and stronger emergence than the control, the final emergence percentage of the dipped sets being 99·2 and 100 for solutions A and B, respectively, as against 87·8 for the control, or an advantage of the dipped sets of 11·4 to 12·2 per cent. over the control. An approximate estimate of blanking made by a farmer assessed it at 0·5 to 1 per cent. for dipped stocks, and at 10 per cent. for the control. Dipped tubers produced a greater weight of crop: the seed size of $1\frac{1}{4}$ to $1\frac{3}{4}$ in. yielded with solution A, 100 lb.; solution B, 110·15 lb.; and control, 67·53 lb., or a loss of 32·47 to 42·62 per cent. of potential seed. It is noted as a point of interest that the total weight seems, at least under the conditions of the present experiment, to be related to the emergence percentage, e.g., loss of emergence in the untreated controls, 11·4 to 12·2 per cent.; loss of crop, 11·49 to 11·8 per cent.

BLAIR (I. D.). **Behaviour of the fungus Rhizoctonia solani Kühn in the soil.**—*Ann. appl. Biol.*, xxx, 2, pp. 118–127, 1943.

The saprophytic behaviour of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xxi, p. 412] was studied in natural unsterilized soil by the Rossi-Cholodny soil-plate method [ibid., xiv, p. 469]. Tested in glass tumblers over a range of soil moisture

contents from 30 to 80 per cent. saturation, the fungus grew best at the lowest and least at the highest level. This decline in growth was attributed to a decrease in soil aeration accompanying rising soil moisture content, since in sand, where aeration is better than in any soil, the growth of the fungus was least affected by the rise of soil moisture content. This hypothesis was confirmed in tests with the same range of soil moisture contents, in which forced aeration of the soil was found to increase significantly the growth of the fungus, while the admixture of bentonite with sand, which retards the natural aeration, had the expected effect of significantly reducing the growth. A neutral soil reaction was optimal for the growth of *C. solani*, which grew well over the range P_H 5·8 to 8·1.

In experiments with glass tubes, 30 cm. long, containing sand, growth of the fungus ceased after 13 days when the hyphae extended to some 5 cm. beyond the inoculum; in three different soil types, on the other hand, the growth continued for another eight days for a further 12 to 17 cm. The removal of the agar inoculum disk from the glass tube after two days or the substitution of mycelial strands as inoculum, diminished growth of the fungus greatly in the sand, but affected it only slightly in the three soils. It is concluded from these results that the fungus derives nourishment from the soil, although a certain 'food potential' of the inoculum may be necessary to initiate, though not to maintain, its saprophytic growth through the soil. Development of sclerotia was observed against the glass walls up to the sixth day after inoculation, none forming farther than 6 cm. from the inoculum. Sclerotial production was very sparse in sand (7 as against 39, 59, and in 64 in the Hardwood, allotment, and Woburn soils, respectively), probably owing to a scarcity of inorganic nutrients. In radish seedlings sown in two types of soil at a range of distances from the agar inoculum disk, the percentage of pre-emergence killing tended to decrease with increasing distance of the seed from the inoculum. In both soil types, 100 per cent. of seedlings damped-off after 16 days at the 4 cm. distance, while the percentage decreased again at distances exceeding 4 cm. Essentially similar results were obtained with the same two soil types, but at each of the two moisture levels, 33 and 50 per cent. saturation, the progress of damping-off being, as was indicated by earlier tests, more rapid at the lower level.

The addition of organic materials, such as grass, farmyard manure, adco and city refuse composts, wheat straw, and lucerne meals, was found to depress the growth of the fungus in all soils tested. When, on the other hand, both the soil and the organic supplements were sterilized before mixing, the growth of the fungus was not depressed. The inoculation of sterilized soil-organic meal mixtures with *C. solani* and mixed fungus inocula (inoculum A = *Penicillium terrestre*, *P. intricatum*, and *Aspergillus flavipes*; and B = *Gliocladium roseum*, *Rhizopus elegans*, and *Trichoderma viride*) resulted in a depression of growth of *C. solani* to the level of similarly inoculated unsterilized series. In a parallel experiment with soil receiving no organic supplements, sterilization failed to increase the growth of *C. solani*, but the addition of mixed fungus inocula significantly depressed it both in the non-sterilized and the sterilized soil, particularly in the latter. These experiments are taken to demonstrate that the depressing effect of the organic supplements upon the growth of the fungus through unsterilized soil is due to microbiological action. It was further shown that (1) the cellulose-decomposing ability of *C. solani* is weaker than that of eight other fungi selected as typical cellulose decomposers, (2) the addition of nitrogen fails to counteract completely the depressing effect of organic supplements upon the growth of the fungus or to increase the growth in soil receiving no such supplements, and (3) the reduction of the carbon dioxide content of the soil atmosphere (achieved by the introduction of a saturated solution of alkali into the experimental clay crocks) improves the growth of *C. solani* in the soil-straw meal series until it almost equals that in the

untreated soil. It was found that where either grass or straw meal had been added to the soil the optimum P_H value for growth rose from 7 to 8, this result agreeing with the hypothesis that the accumulation of respiratory carbon dioxide is one of the factors limiting the growth of *C. solani* in soil treated with organic grass or straw meal.

CRALLEY (E. M.) & ADAIR (C. R.). **Effect of irrigation treatments on stem rot severity, plant development, yield, and quality of Rice.**—*J. Amer. Soc. Agron.*, xxxv, 6, pp. 499–507, 1943.

A tabulated account is given of experiments conducted from 1933 to 1940 at Stuttgart, Arkansas, to determine the effect of various irrigation treatments on the severity of stem rot (*Leptosphaeria salvinii*), plant development, yield, and milling quality of the Supreme Blue Rose, Caloro, Lady Wright, Early Prolific, Fortuna, and Kameji × Blue Rose rice varieties. The virulence of the fungus was slightly reduced by withholding water from the experimental plots for certain periods before harvest [*R.A.M.*, xiii, p. 395] and by alternate draining and submergence during the latter part of the growing season. The average yields, however, were somewhat higher from plots irrigated normally, i.e., submerged continuously during the late vegetative period. The data indicate that early draining, practised in fields lightly infested with stem rot, does not increase rice production. None of the modifications of the normal irrigation system augmented plant height, tillering, panicle weight, or yield, nor did they improve the milling quality of the crops.

CHIN (W. F.). **A preliminary study on the physiological differentiation of Fusarium fujikuroi (Saw.) Wr.**—*Nanking J.*, ix, pp. 305–321, 1940.

A number of isolates of *Fusarium* [*Gibberella*] *fujikuroi* (Saw.) Wr. were compared for pathogenicity to rice by planting aseptically germinated seedlings in inocul. sterilized soil cultures on mixed steamed carrot and maize stems. The cultures were divisible into three groups, all causing pallor or yellowing of the plants, while one also induced dwarfing, the second elongation, and the third no effect on the size of the host. All cultures were found to grow well on natural plant media (carrot, potato, sweet potato, and radish agar slants, maize and *Dolichos* stems, and rice straw), and could not be satisfactorily distinguished on these media. There was some difference in the growth rates on potato dextrose agar, the dwarfing type developing most rapidly, the elongation type [*R.A.M.*, xx, p. 594] moderately fast, and the 'normal' type most slowly.

When grown on Knop's solution or a modification of Richards's liquid medium, all the types produced a toxin which resulted in yellowing, stunting, production of brown lesions, withering, and usually death of the plants. There was some slight correlation between intensity of action at low dilutions and degree of stunting of plants in infected soil, but the toxicity test is considered unsuitable as a means of differentiating the three main types.

SMITH (K. M.). **A virus disease of Atropa belladonna.**—*Parasitology*, xxxv, 3, pp. 159–160, 1 pl., 1943.

A preliminary account is given of a virus disease of *Atropa belladonna*, first observed on specimens from Suffolk in 1941 and again recorded in 1942 in Surrey, where the crop is being cultivated for medicinal purposes. This is believed to be the first report of a spontaneous infection of virus origin on the host in question. Under outdoor conditions the plants develop severe foliar and stem necrosis, while in the greenhouse the leaves display a somewhat patchy mottling and a number of necrotic spots. The virus is transmissible by means of the sap to its own host (with much difficulty), *Hyoscyamus niger*, *Solanum nigrum*, *Datura stramonium*,

White Burley and Turkish tobacco, *Nicotiana glutinosa*, and Canadian Wonder French bean.

The dilution end point of the virus in crude extracted sap lies between 1 in 10,000 and 1 in 1,000. It is not destroyed by five minutes' exposure to a temperature of 75° C., the inactivation point probably lying between 75° and 80°. Positive infections were obtained after six (but not eleven) days' ageing in extracted sap at room temperature.

ARRUDA (S. C.). **A Cana de Açúcar e o problema das doenças.** [Sugar-Cane and the disease problem.]—*Biológico*, vii, 10, pp. 271–280, 1941.

This is a concise survey of the distribution, symptomatology, and possibilities of control of the fungal, bacterial, and virus diseases of sugar-cane, with special reference to the conditions prevailing in São Paulo and elsewhere in Brazil.

ARRUDA (S. C.). **A história das grandes epifitias da Cana de Açúcar.** [The history of the major epiphytotics of Sugar-Cane.]—*Biológico*, vii, 11, pp. 313–318, 2 diags., 1 graph, 1941.

The epidemic of mosaic among the susceptible 'noble' sugar-cane varieties, exclusively cultivated in São Paulo at the time of the introduction of the virus into all the chief American centres of the industry (1920 and onwards), is estimated to have caused a reduction in yield, between 1923 and 1925, of 58 per cent., representing a financial loss of \$10,990,000,000 [*R.A.M.*, ix, p. 807]. The substitution for this susceptible group of canes of resistant varieties, such as P.O.J. 213 and 36 and Co. 281 and 290, led to a rise in output from 477,000 tons per ha. in 1925 to 1,965,000 in 1932.

Brazil was the first country to suffer collapse of the sugar-cane industry through the ravages of *Phytomonas* [*Xanthomonas*] *vasculorum*, which occurred in the State of Bahia in 1860.

Notes are also given on the sereh and red rot [*Colletotrichum falcatum*] epidemics in Java (1882) and the West Indies (1895), respectively, and the paper concludes with a survey of the work, initiated at the time of the former and still proceeding, on the development of disease-resistant varieties.

MCMARTIN (A.). **Red rot in Sugarcane in Natal.**—*S. Afr. Sug. J.*, xxvii, 5, pp. 209, 211, 1943.

Red rot of sugar-cane (*Colletotrichum falcatum*), first detected in Natal by the writer towards the end of 1941 [*R.A.M.*, xxi, p. 222], has been responsible for considerable losses in some areas, a reduction of 50 per cent. being not uncommon. Of the released varieties, Co. 290 and P.O.J. 2725 are the only ones affected, Co. 281 and Co. 301 being apparently resistant. Cases have been observed at the Mount Edgecombe Experiment Station in which dead Uba canes were found to be producing spores of the pathogen without showing any sign of the typical red internal discoloration, suggesting that similar material may possibly have been the source of the present outbreak, and also that red rot may have killed the dead sticks of Co. 290 found in other areas. In this event, infection may be fairly widespread but only developing on an important scale in regions where suitable climatic conditions prevail. The prevalence of the disease at high elevations in Natal is tentatively attributed to the persistence of damp mists over the fields for longer periods than in the lower-lying coastal districts.

One method of infection by *C. falcatum* in the field, apparently not recorded from any other country, is through the leaf sheaths of one-year-old cane, on which discoloured areas somewhat resembling those of eye spot [*Helminthosporium sacchari*] are formed, the fungus passing thence into the young internodes. Pre-

sumably it travels upwards from the disintegrating refuse at the stem bases along the outside of the stem or leaf sheaths.

C. falcatum is constantly associated with a *Fusarium* of the *F. moniliforme* [*Gibberella fujikuroi*] group, which can be grown in culture for a longer period than the red rot fungus and still retain its pathogenicity (30 days in one experiment). Canes inoculated with combined cultures of the two organisms developed more characteristic symptoms of red rot than did those infected with either singly. In the field *G. fujikuroi* causes both the top rot familiar in other countries and an internal red discoloration, and the evidence indicates that it may be an important factor in the etiology of red rot, and not merely a secondary invader. The symptoms induced by inoculation with *C. falcatum* vary considerably, the age of the culture being one of the determining factors; at four to six days the pathogen appears to exert its most typical effects.

D[odds] (H. R.). **Experiment Station notes.**—*S. Afr. Sug. J.*, xxvi, 4, p. 213; 7, pp. 367, 369; 8, pp. 419, 421, 1942; xxvii, 2, p. 99; 6, p. 271, 1943.

The following items, *inter alia*, occur in the Botanist's Reports incorporated in these notes from the South African Sugar Association's Experiment Station, Mount Edgecombe, Natal. An unusually heavy outbreak of ring spot (*Leptosphaeria sacchari*) on Co. 281 was observed during April, 1942, imparting a rusty appearance to the affected areas, and the same variety has recently also been extensively attacked by *Cercospora longipes*.

During July, 1942, the following varieties in a field collection were found to be infected by red rot [*Colletotrichum falcatum*: see preceding abstract]: Clarke's Seedling, Co. 419, Black Cheribon, H.M. 619, S.C. 12/4, J. 247/B, R.P. 8, and M.P.R. 151, while (Co. 421 × Co. 312) and N. Co.'s 294, 296, 297, 300, 320, 321, 288, 285, 284, 283, 278, 258, 260, 262, and 265 were attacked in the seedling propagation plots. In August, 1942, the disease was further detected on P.O.J. 2725, M.P.R. 28, and 61, S.W. 499, B. 726, and N.Co.'s 312 and 257, and in February, 1943, on N.Co.'s 357, 352, 346, and 293.

Streak was found in July 1942, on Co. 455, N.M. 186 and 191, and Kham, and in June, 1943, on N.Co. 162.

In the latter month, *Puccinia kuehnii* was observed for the first time at the Experiment Station on Co. 301. At the same time, a survey to determine the extent of pineapple disease [*Ceratostomella paradoxa*] on Co. 331 revealed its presence in every field in which the variety was grown. The fungus appears to be present on the outside of the stalks, entering them when they are cut and used for planting. Treatment of the cut ends with mercuric chloride prevented infection through this channel.

A leaf spot resembling the target blotch [*Helminthosporium* sp.] prevalent in Cuba was observed on M.P.R. 151, this being the first record of its appearance in Natal.

Stevenson (J. A.). **A possible reprinting of Saccardo's Sylloge Fungorum.**—*Phytopathology*, xxxiii, 7, p. 635, 1943.

A recent announcement by the Alien Property Custodian concerning the availability for republication of many technical books and sets of books of enemy origin suggests to those interested the possibility of the reproduction of the 25 volumes of Saccardo's 'Sylloge Fungorum' [cf. *R.A.M.*, xxii, p. 113]. It has been ascertained that the complete set could be secured at $200.00 per set if 100 subscriptions are forthcoming, while 300 would permit of a reduction to $150.00. These prices are based on an offset edition with a 10 per cent. photographic reduction of the type block.

BOSE (S. R.). **Researches on Bengal Polyporaceae.**—University of Calcutta, Kirtikar Memorial Volume No. 1, 101 pp., 5 pl. (2 col.), 1942.

This volume, published in memory of Lt.-Col. K. R. Kirtikar, I.M.S., who devoted much time to the study of Bombay fungi, contains four papers on Bengal Polypores, embodying work carried out by the author with the assistance of Sudhirkumar Sen, S. N. Sarkar, N. C. Goswami, and P. N. Nandi. These papers, all of which are reprinted from various journals, deal with (1) the sexuality of *Polyporus ostreiformis* and *Polystictus hirsutus*, (2) enzymes of some wood-rotting Polypores [*R.A.M.*, xvii, p. 88], (3) the effects of radiation on some Polypores in culture, and (4) the nature of the colouring substance in coloured Polyporaceae [ibid., xxi, p. 36].

ZUNDEL (G. L.). **Notes on the Ustilaginales of the world. III.**—*Mycologia*, xxxv, 2, pp. 164–184, 4 figs., 1943.

Among the species given in this annotated list of smuts from different parts of the world [*R.A.M.*, xvii, pp. 204, 704, 772; xix, p. 120] mention may be made of *Sphacelotheca schweinfurthiana* (Thüm.) Sacc. var. *minor* Zundel, var. nov., in which the spores measure 7 to 9 μ in diameter (found on *Saccharum arundinaceum* in China) and *Polysaccopsis hieronymi* (Schröt.) P. Henn. (syn. *Urocystis hieronymi*) on *Solanum* sp. in Argentina, Bolivia, and Brazil, in which the sori are 3 to 5 by 1·5 to 2·5 cm., and the globose to ellipsoidal or irregular, chestnut-brown, smooth spores are mostly 22 to 26 μ long.

MUNDKUR (B. B.) & KHESWALLA (K. F.). **Dasturella—a new genus of Uredinales.**—*Mycologia*, xxxv, 2, pp. 201–206, 4 figs., 1943.

The authors erect a new genus, *Dasturella*, for two collections of rust on *Dendrocalamus strictus* and one on *Bambusa* sp. received at Pusa. Pycnidia and aecidia are unknown; the uredosori are minute, at first subepidermal, later erumpent, paraphysate, without peridia; uredospores sessile; teleutosori subepidermal, erumpent; teleutospores fascicled into large, coloured, sessile heads without cysts, 3- to 6-, rarely 7-celled. The type species, *Dasturella divina* (Sydow) comb. nov., found on leaves of *Dendrocalamus strictus* and *D.* sp. (nec *Bambusa* sp.) is characterized by sessile, almost globose to egg-shaped or ellipsoidal, echinulate uredospores measuring 18 to 26 by 15 to 23 μ, with a wall up to 1·5 μ thick, and 3 to 4 rather indistinct equatorial germ pores, sessile teleutospores arising from a cellular sheet, 59 to 114 by 8 to 17 μ, with side walls up to 1 μ thick, and the apical wall 3·7 to 11·7 μ thick, dark cinnamon-brown, 3- to 6-, rarely 7-celled.

Dasturella bambusina n.sp. (found on bamboo leaves) has ovoid to elliptical, finely echinulate, orange to pale yellow uredospores, measuring 22 to 29 by 17 to 21 μ with two germ pores, and sessile teleutospores, arising from a cellular sheet, 43 to 95 by 11 to 17 μ, with the apical wall 4·7 to 9·3 μ, and the side walls thin, deep cinnamon-brown, 3- to 5-celled.

OVERHOLTS (L. O.). **Mycological notes for 1939–40.**—*Mycologia*, xxxv, 2, pp. 243–254, 7 figs., 1943.

This annotated list of new and unusual fungi encountered during 1939 and 1940 includes *Poria cognata* n.sp. (on a stump of chestnut (*Castanea dentata*), Tennessee), *P. grandis* n.sp. (on rotted conifer logs, Tennessee), *Beauveria globulifera*, found on a locust in Pennsylvania, and *Stilbella acerina* n.sp., inhabiting spots on leaves of *Acer rubrum* in Tennessee in conjunction with *Phyllosticta acericola*.

WHETZEL (H. H.). **The spermodochidium, an unusual type of spermatial fruit-body in the Ascomycetes.**—*Mycologia*, xxxv, 3, pp. 335–338, 1943.

The author introduces a new term, spermodochidium (pl. spermodochidia), which

he defines as a spermatial fruit-body in which spermodochia are housed in a distinctive lysigenous cavity in the tissues of the suscept plant. Previously (*Mycologia*, xxix, p. 135, 1937) the author defined the term spermodochium (pl. spermodochia) as a spermatial fruit-body characteristic of many Discomycetes, which is naked and not enclosed in a hyphal wall, the spermatiophores arising from a central or basal hyphal-centrum. Spermodochidia are stated to be typical of those *Sclerotinia* spp. that attack members of the Cyperaceae and Juncaceae, e.g., *S. duriaeana*, *S. longisclerotialis*, and *S. scirpicola*.

WHETZEL (H. H.). **A monograph of Lambertella, a genus of brown-spored inoperculate Discomycetes.**—*Lloydia*, vi, 1, pp. 18–52, 6 pl., 7 figs., 1943.

In this monograph the author recognizes eight species of *Lambertella*, namely, the type species *L. corni-maris* [*R.A.M.*, xiv, p. 451], six new species, and one new combination. He proposes the establishment of a new family, the Sclerotiniaceae, to comprise those species, now commonly included in the Helotiaceae, in which the apothecia arise from a stroma. As the author now interprets the genera concerned, *Ciboria* is quite distinct from *Lambertella* [loc. cit.]. Observations and experiments indicate that the species of the latter genus are only mildly pathogenic, most, if not all, attacking only the mature or ripening organs of the suscepts. Harrison and El-Helaly [loc. cit.] found *Monilia* [*Sclerotinia*] *fructigena* to be 17 times as destructive to apples as *L. corni-maris*, and in the author's laboratory the latter readily invaded only ripe fruits of *Cornus mas*.

The most salient characters of the genus would appear to be the peculiar semi-stroma with its characteristic rind pattern and the coloured ascospores. The somewhat thickened face of the spore wall also seems to possess generic significance. Throughout the Sclerotiniaceae the characters of the stroma usually constitute the most reliable basis for generic segregation.

BLACKWELL (ELIZABETH). **The life history of Phytophthora cactorum (Leb. & Cohn) Schroet.**—*Trans. Brit. mycol. Soc.*, xxvi, 1–2, pp. 71–89, 6 figs., 1 diag., 1943.

In this very detailed account of the life-history of *Phytophthora cactorum*, a paragynous, homothallic species, the author discusses the formation and germination of the oospores, chlamydospores, conidia, and zoospores as well as the perennation of the mycelium as old dormant portions of hyphae plugged off from the rest. The best method of distinguishing chlamydospores from oospores is to examine them between crossed nicols: the former are much brighter than the latter. The oospore is unique among the resting spores in that it has, *inter alia*, a period of rest after maturation during which it is difficult, if not impossible, to induce germination by artificial means. The cytological details of the fertilization of the oosphere, the maturation of the oospore, and the changes that take place in dormancy, are given in full. Each oospore is an independent product that matures in its own time and before germination each requires a further period corresponding to the 'after-ripening' period of seeds. At laboratory temperature this period may be six or seven months, but at just above freezing point it can be speeded up to one or two months. Even when the 'after-ripening' period is completed the oospore may continue to lie dormant for many months more. Throughout dormancy the oospore must be kept moist; desiccation means death. Preparation for germination is marked by the development of a characteristic dull, soft, granular appearance, in striking contrast to the bright, hard, and 'glassy' dead oospores. Various changes in the contents of the oospores take place before the emission of the germ-tube, and are described. The oospores that fail to germinate after the completion of the 'after-ripening' period, enter upon a second, even more resistant, dormancy, which may last many months. It is

concluded that the precise conditions necessary for the germination of oospores lie within very narrow limits and that, moreover, each oospore being a slightly differently organized unit, it may require a slightly different set of conditions.

WEI (C. T.). **Notes on Chinese Fungi X. Erysiphaceae of Western Szechuan.**—*Nanking J.*, xi, pp. 103–116, 1942.

These notes describe 22 species and varieties of Erysiphaceae collected in western Szechuan from 1938 to 1941 by the author and T. K. Zi. One new species and one new variety are described, and two new combinations proposed.

Ito and Hara (*Bot. Mag., Tokyo*, xxix, p. 338, 1915) erected the genus *Typhulochaeta* to accommodate a specimen occurring on *Quercus*, on the basis of what they regarded as a hitherto unrecorded type of appendage. The author finds that these are merely penicilliate cells, and true apical appendages. He therefore rejects the genus and renames the species *Erysiphe japonica* (Ito & Hara) Wei comb. nov. His specimens were collected on *Castanopsis* sp. and *Q. aliena*.

The name *Uncinulopsis polychaeta* (B. & C.) Wei on *Celtis sinensis* is 're-established according to Article 54 of the International Rules for Botanical Nomenclature'. Full reasons for the change are not given.

Uncinula miyabei (Salm.) Sacc. var. *aleuritis* Wei var. nov. on *Aleurites fordii* differs from the type in having fewer appendages and larger asci (50·4 to 71·4 × 37·8 to 56 μ).

COSTA (A. S.). **Uma mela das sementeiras de Fumo causada por Rhizoctonia solani Kühn.** [A mildew of Tobacco seedlings caused by *Rhizoctonia solani* Kühn.]—*Biológico*, vii, 11, pp. 323–324, 2 figs., 1941.

Tobacco seedlings of the Turkish, Amarelinho, Sumatra, and Goiano varieties at the Institute of Agronomy, São Paulo, were recently attacked by a disease of the damping-off type, which was found to be caused by *Rhizoctonia* [*Corticium*] *solani*. The pathogen, which is of unusual occurrence locally, is favoured by an excess of humidity and thrives in shaded situations. Sterilized soil should be used for seed-beds, and cases of partial infection may be combated by exposure of the plants to direct sunlight.

SMITH (T. E.) & SHAW (K. J.). **Pathogenicity studies with Fusaria isolated from Tobacco, Sweet Potato, and Cotton.**—*Phytopathology*, xxxiii, 6, pp. 469–483, 2 figs., 1943.

Pathogenicity trials with 53 collections of *Fusarium* from various commercial types of tobacco (considered representative of *Fusarium* wilt as it occurs in the United States, where it is commonly attributed to *F. oxysporum* var. *nicotianae* [*R.A.M.*, xix, p. 678]) demonstrated that the disease was caused by races of the fungus that were also pathogenic to sweet potato or cotton, but not to both. The race pathogenic to sweet potato was present in almost all collections in North and South Carolina and Georgia from flue-cured tobacco, and in Maryland from Maryland tobacco. Races pathogenic to sweet potato or cotton were collected in about equal numbers in Kentucky from Burley and dark tobaccos.

Pathogenicity trials with 22 collections of *Fusarium* from sweet potato (*Fusarium* wilt of which is commonly attributed to *F. bulbigenum* var. *batatas* and *F. oxysporum* f. 2) [ibid., xix, pp. 327, 388] showed that all were pathogenic to Burley tobacco and some to flue-cured tobacco, though none was pathogenic to cotton.

Trials with 19 collections of *Fusarium* from cotton (wilt of which is commonly attributed to *F. vasinfectum*) showed that all were pathogenic to Burley tobacco, slightly so or negative to flue-cured tobacco, and negative to sweet potato.

All 94 collections fell into three physiologic races on a basis of inoculation

results on flue-cured tobacco, Burley tobacco, sweet potato, and cotton, from which it is concluded that pathogenicity should be the principal criterion for the classification of wilt-producing species of *Fusarium*.

The use of crop rotations combining sweet potato and all types of tobacco is a dangerous practice, as both crops are susceptible to a common and widespread race of *Fusarium*. In areas where wilt is present on flue-cured tobacco the combination is exceptionally risky. The growth of Burley and dark tobaccos in rotation with cotton also appears to be unwise. Flue-cured tobacco may, however, safely be rotated with cotton.

NORRIS (D. O.). **Strains of spotted wilt virus and the identity of Tomato tip-blight virus with spotted wilt.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 2, pp. 91–92, 1 fig. (following p. 112), 1943.

The author has obtained evidence that the tomato spotted wilt virus is a complex of related strains, probably three, one of which (the necrotic) appears to be identical with tomato tip blight [*R.A.M.*, xviii, p. 420; xxi, p. 354]; the others are the ring spot and mild strains. No tip blight, indicating complete separation of the necrotic strain, has yet been observed in Australia.

HILL (A. V.). **Insect transmission and host plants of virescence (big bud of Tomato).** —*J. Coun. sci. industr. Res. Aust.*, xvi, 2, pp. 85–90, 2 pl. (following p. 112), 1943.

This paper lists the 65 species of plants, belonging to 24 families, on which the virescence or greening, which appears to be due to tomato big bud virus [*R.A.M.*, xx, pp. 182, 235], has been observed in New South Wales. Greening of the floral parts is characteristic of the disease, which generally appears after mid-December, but occurs in summer-flowering annuals as early as November. At Canberra, in 1941–2, over 50 per cent. of annual aster (*Aster* sp.) plants were affected. Spring-flowering annuals were unaffected, but if abnormal conditions caused such plants to grow during summer, virescence occurred in some species. Spread by vegetative propagation of infected plants before symptoms appeared was observed in chrysanthemums and dahlias. As a rule, the first flowers produced by infected spring-flowering perennials, and sometimes flowers produced in late autumn, appeared healthy, but during the warmer period all were virescent. In most plants, the symptoms develop chiefly in the flowering parts, hence in some biennials the disease, though present, may not be apparent during the first season. This is important where parsnips, carrots, and celery are grown for seed.

The disease was readily transmitted by grafting infected tomato, tobacco, egg-plant, black nightshade (*Solanum opacum*), or common thorn apple (*Datura stramonium*) to healthy plants of each of these species. It was not transmitted when scions from non-solanaceous virescent plants were grafted with healthy host plants susceptible to big bud. It was, however, obtained by grafting from phlox to phlox and from *Antirrhinum* to *Antirrhinum*.

It was transmitted experimentally by nymphs or adults of the jassid *Thamnotettix argentata* to 23 species of plants belonging to 13 families. The symptoms appeared in 24 to 155 days, this interval largely depending on the length of the period between infection and flowering and on the season of the year. In many plants, the condition was accompanied by the development of axillary buds into short branches bearing numerous small leaves with short petioles, the affected plant assuming a compact, stunted appearance. In many cases the floral axis of diseased flowers continued to elongate, and further differentiation occurred until the floral axis resembled a stem with virescent flowers or clusters of small, leaf-like structures at intervals along its length.

Bawden (F. C.) & Pirie (N. W.). **Methods for the purification of Tomato bushy stunt and Tobacco mosaic viruses.**—*Bio-chem. J.*, xxxvii, 1, pp. 66–70, 1943.

The authors describe new and improved methods of purification of tomato bushy stunt [*R.A.M.*, xviii, p. 143] and tobacco mosaic [ibid., xvii, p. 564] viruses, which involve only ordinary low-speed centrifugation. The bushy stunt virus prepared by the new method, involving no heating, is stated to be at least 10 times as infective as virus made by the method involving heating [see next abstract]. As the virus content of infected tomato leaves is at least five times as great as that of the stems, the inclusion of the latter in the preparation is not considered advisable, particularly since it greatly increases the labour of mincing. Freezing the leaves facilitates subsequent mincing, but seems to have no further advantages; there is no evidence that it causes loss of virus.

The method described for the purification of tobacco mosaic and aucuba mosaic viruses is considered satisfactory, there being no evidence of any great inactivation. The authors' view that preparations of tobacco mosaic virus are not homogeneous and consist of rods of equal cross-section but variable length, has received support from Frampton's measurements [ibid., xxi, p. 307].

Bawden (F. C.) & Pirie (N. W.). **The inactivation of Tomato bushy stunt virus by heating and freezing.**—*Bio-chem. J.*, xxxvii, 1, pp. 70–79, 1943.

Heating purified preparations of tomato bushy stunt virus [see preceding abstract] at P_H 6 for 10 minutes to a temperature of 85° [C.] was found to result in complete loss of infectivity; partial loss occurred over a wide range of temperatures (from 45° to 80°, but mostly below 60°). On the other hand, loss of serological activity, accompanied by coagulation, took place only within the narrow temperature limits of 80° to 85°. The amount of heating needed for denaturation was lower at P_H 4 than at the higher values within the range of 4 to 9. The chemical and physical properties of virus material rendered non-infective by an amount of heating insufficient to destroy its serological activity, did not differ in any way from those of fully active preparations.

The rate and extent of inactivation induced by freezing was intensified by increases in the concentration of the virus, the duration of freezing, and the acidity of the fluid. Salts and other substances present protected the virus from inactivation, the efficiency of different salts depending on the salt : ice : water eutectic temperature. In general, loss of infectivity in frozen samples of the virus was accompanied by a corresponding loss of serological activity, but under certain, as yet not fully defined, conditions freezing destroyed the infectivity without affecting the serological activity.

In conclusion it is suggested that since so many treatments seem to destroy infectivity without altering the physical, chemical, or serological properties of a virus, attempts to assess the homogeneity of purified virus preparations are likely to give indecisive results until much more sensitive methods of testing for infectivity are evolved.

Stuntz (D. E.) & Seliskar (C. E.). **A stem canker of Dogwood and Madrona.**—*Mycologia*, xxxv, 2, pp. 207–221, 6 figs., 1943.

During the past few years *Cornus nuttallii* and *Arbutus menziesii* trees in and in the vicinity of Seattle have become increasingly affected by cankers which girdle the stem and eventually prove fatal. The leaves in the top of the crown turn brown and fall, this being followed by complete defoliation and the ultimate death of the tree. The condition in the crown is reflected in the cankerous condition of the stem.

Bits of tissue from cankers on both tree species were incubated, and two organisms were obtained, a *Phomopsis*, later found to be a secondary parasite, and a

species of *Phytophthora*, identified as *P. cactorum* [cf. *R.A.M.*, xvii, p. 182]. This is the first record of *P. cactorum* on these two hosts.

Thirteen of 16 stem inoculations on *C. nuttallii* produced characteristic cankers, while four soil inoculations failed. On *A. menziesii* 15 of 16 stem inoculations gave positive results, as did two of four soil inoculations. The fungus was also found by inoculation tests to be quite virulent on *Acer macrophyllum*, and able to attack *Pseudotsuga taxifolia*, *Alnus rubra*, *Salix scouleriana*, and *Corylus californica*. Both inoculation tests and field observations indicated that it is more pathogenic to *Arbutus menziesii* than to *Cornus nuttallii*. Re-isolations from the experimentally induced cankers on both of the last-named were identical with the original pathogen. Scarification of the artificially induced cankers has so far prevented further spread.

LARGE (J. R.). **Recent observations on threadblight, Corticium stevensii, of Tung and some native plants in the southeastern United States.**—*Plant Dis. Reptr*, xxvii, 10–11, pp. 223–224, 1943. [Mimeographed.]

Thread blight due to *Corticium stevensii* [*R.A.M.*, xxii, p. 33] is one of the most serious diseases of tung [*Aleurites* spp.] trees in the United States. It has been reported on at least 20 southern hosts, including tung, at Gainesville, Florida. Records on tung include one from Florida, five from Louisiana, and one from Mississippi. Most of the infected orchards are near swamps, and in two swamps in Louisiana *Liquidambar styraciflua*, *Nyssa sylvatica*, *Cornus florida*, *Malus angustifolia*, *Rubus* sp., *Aquilegia canadensis*, *Ilex opaca*, and *I. glabra* were found infected.

Pruning and burning the affected shoots at weekly intervals from June to October kept a serious epidemic in check in one orchard. Summer sprays of Bordeaux mixture (6–6–100) plus 1 per cent. summer oil or of Bordeaux mixture (6–2–100) reduced infection both in severity and extent to about one-third. The best time to spray seemed to be June. Annual spraying is uneconomical. It is recommended that one or two summer sprays of Bordeaux mixture (6–2–100) should be given, followed after 30 days by the pruning-out of any diseased twigs remaining.

TEHON (L. R.). **Diseases of trees. Gleanings from the latest reports of scientific research.**—*Amer. Nurserym.*, lxxvi, 10, pp. 28–29, 1942.

The results of tests conducted by W. C. George in North and South Carolina and Georgia since 1937 have shown that damping-off, chiefly due to *Rhizoctonia* [*Corticium solani*: *R.A.M.*, xix, p. 681; xxi, p. 508; xxii, p. 158], of longleaf pine [*Pinus palustris*] can be adequately combated by the use of a shallow ($\frac{1}{4}$ in. thick) seed cover of old pine sawdust and the application to the seedlings of semesan at the rate of $\frac{1}{10}$ oz. in $\frac{3}{4}$ pt. water per sq. ft., which in one test reduced the incidence of infection from 50 to 10 per cent. The compound is apt to cause scorching, and treatments should only be made in the late afternoon or on cloudy days. In some cases the introduction into the soil, before sowing, of iron sulphate ($\frac{3}{8}$ oz. in 1 pt. water per sq. ft.) has given satisfactory results, while commercial ortho-phosphoric acid ($\frac{1}{8}$ fluid oz. per sq. ft.) was also partially effective, and a combination of these two materials, both of which operate by changing the acidity of the upper $\frac{1}{2}$ in. of soil, holds some promise.

SOUTHAM (C. M.) & EHRLICH (J.). **Effects of extract of Western Red-Cedar heartwood on certain wood-decaying fungi in culture.**—*Phytopathology*, xxxiii, 6, pp. 517–524, 1 fig., 1943.

In studies on the effects of western red cedar (*Thuja plicata*) heartwood extract on the growth of wood-destroying fungi in culture, hot water-soluble extractives were mixed in various concentrations (from $\frac{1}{4}$ to 24 per cent.) with malt agar

medium on which the following fungi were then grown: *Trametes serialis*, *Fomes roseus*, *T. subrosea*, 'Madison 517', *Lentinus lepideus*, *Polyporus sulphureus*, *F. officinalis*, *P. schweinitzii*, *F. pinicola*, *Coniophora puteana*, and *Poria xantha* f. *crassa*.

The results showed that when the concentration of the extract was 4 per cent. or more, the growth rate of all the fungi was retarded, while somewhat higher concentrations completely prevented growth. When the non-growing pieces were removed after the test period to ordinary malt agar medium it was found that some, but not all, of the transfers grew. In extreme dilutions of the extract many of the fungi showed an increase in growth rate, though this gradually decreased and approached the normal rate. Fungistasis decreased with time, and when transfers were made from malt agar containing the highest percentage of extract on which each fungus originally grew to a somewhat higher percentage of extract, it was found that each fungus had become able to grow on these higher concentrations, from which they could be re-transferred to even higher ones.

In media containing extract a zone of decoloration was noted, extending 1 cm. or less beyond the periphery of the mycelium of *F. officinalis*, *F. pinicola*, *P. xantha* f. *crassa*, and *T. serialis*. This is considered to have resulted from the leaching of metabolic products from the fungus into the surrounding medium. Apparently, the fungi producing the decoloration change chemically the toxic portion of the extract to a non-toxic material before advancing. Ability to overcome increasingly high concentrations of the toxic heartwood extract in this manner may account for the advance of decay-producing fungi through the heartwood of living western red cedar trees.

BOYCE (J. S.) & HEPTING (G. H.). **Decay of wood in aircraft.**—*Spec. Release Div. For. Path. U.S. Dep. Agric.* 12, 4 pp., 1943.

Examination of over 50 older commercial and private aeroplanes showed that decay [unspecified] in wooden parts is infrequent in spite of the fact that susceptible woods are being used without preservative treatments. Where decay has occurred, it has almost invariably been due to faulty design, carelessness in construction, or improper care. As there is no authenticated record of wood decay having occurred at moisture content below 25 per cent., aeroplane construction should aim at keeping water out by shielding all openings and drain holes, as well as by providing sufficient numbers of the latter to let water escape. In maintenance, wood should be protected from water by improving the drainage of air fields, by using water sparingly in washing, and by clearing drain holes that have become clogged.

LOHMEYER. **Fäulniserscheinungen an unter Wasser eingebautem Holz.** [Symptoms of decay on submerged constructional timber.]—*Bautechnik*, xx, 29–30, pp. 270–272, 1942.

It is only of recent years that the danger of fungal infection on submerged constructional timbers, e.g., bulwarks, piles, bridges, sluices, and the like has been recognized. In Sweden, for instance, T. Lagerberg has investigated cases of decay in entirely submerged wooden structures, which point to the implication of organisms rendered resistant to the ordinarily inhibitive effect of water on fungal development, possibly by the accumulation of oxygen-containing humus. These observations have thrown light on the occurrence of a number of similar cases in Germany, particulars of which are presented in tabular form.

BOND (T. E. T.). **'White spot' of Turnips: a disease new to Ceylon.**—*Trop. Agriculturist*, xcviii, 4, pp. 17–18, 1 pl., 1942.

In December, 1942, turnips in a garden at St. Coombs, Talawakele, Ceylon

(4,500 ft.), were observed to be affected by white spot due to *Cercosporella brassicae* [*R.A.M.*, xvii, p. 587], not previously reported from the island. The spores measured 44·5 to 89·5 by 2 to 3 (mean of 50, 64·9±1·47 by 2·4±0·05) μ. The disease can be controlled by removing the affected leaves or, in severe cases, by spraying with a copper emulsion. The suddenness of the outbreak and its occurrence in a bed of young plants grown from recently imported seed suggest that the disease may have originated in a contaminated seed supply. Seed from affected plants should not be used.

Lorenz (O. A.). **Internal breakdown of table Beets.**—*Mem. Cornell agric. Exp. Sta.* 246, 42 pp., 7 pl., 1 fig., 4 graphs, 1942.

Further studies (under greenhouse conditions) on internal breakdown of beets [*R.A.M.*, xxi, p. 114] showed that when the soil remained at a low moisture content only slight injury to the plants was caused by borax applications even at 300 lb. per acre, though when soil moisture was high a rate of 100 lb. was toxic. A broadcast application of 50 lb. per acre was injurious to young seedlings in a moist soil. Plants in soil kept at a low moisture content but supplied with 200 lb. borax per acre showed characteristic symptoms of boron deficiency. Germination of beet seeds in moist soil remained unaffected when borax was applied broadcast at the rate of 300 lb. per acre.

Interaction was observed between boron and calcium. Growth was increased above that produced in solutions containing 0·01 p.p.m. boron and 10 p.p.m. calcium when the boron concentration was increased without increase in the calcium concentration, or when the calcium concentration was increased without increase in the boron concentration. Boron increments increased growth more effectively at lower than at higher calcium levels. When boron increments at any calcium level were associated with increased growth, they were also associated with greater calcium absorption. Growth was as good for beets grown with the smallest amount of calcium but with the largest of boron as it was for beets grown with less boron but more calcium where 15 times the amount of calcium was absorbed. Hence growth evidently depended not on calcium absorption but probably on calcium utilization.

In a second boron-calcium test conducted in the same manner but with less exposure to light, the growth increase after the plants were transferred from Hoagland solution to one containing 0·01 p.p.m. boron and 10 p.p.m. calcium was 6·92 gm. compared with only 3·47 gm. in the first. Possibly, much of the calcium supplied in the second experiment was utilized, even when the boron concentration in the nutrient solution was low. In the second test, as in the first, calcium utilization was increased at a low level by raising the boron concentration from 0·01 to 10 p.p.m., a result which suggests that boron played some part in calcium utilization even with reduced light.

In a boron-potassium test, increased growth resulted from increase in the concentration of either boron or potassium above the amount in the solution containing 0·025 p.p.m. boron and 14·7 p.p.m. potassium. All plants in solutions with 14·7 p.p.m. potassium developed marginal yellowing of the leaves, while nearly all plants with 0·025 p.p.m. boron showed boron deficiency symptoms, whatever the potassium supply. The boron increments increased growth more effectively at the higher than at the lower potassium levels. With any boron level, growth was directly related to the amount of potassium lost from the solution, but it was not dependent on potassium absorption. Growth in solutions containing 0·150 p.p.m. boron where only 200 mg. potassium were removed was as good as in solutions containing 0·025 p.p.m. boron where seven times that amount of potassium were removed.

Chemical analyses of normal and breakdown tissues in the same beet showed

no consistent differences in dry weight as per cent. of fresh between the two kinds of tissue. On a basis of dry-weight determinations, ash, calcium, magnesium, phosphorus, and iron accumulated in considerable quantities in the breakdown areas, but potassium accumulation was smaller than that of the other minerals. The affected tissue was higher than normal tissue in percentage of total nitrogen and protein nitrogen, but small difference was found between the two kinds of tissue in soluble nitrogen. Total sugars, sucrose, and alcohol-soluble solids were higher in normal tissue, while reducing sugars and starch were higher in the breakdown tissue.

Chemical analyses of plant samples of whole beets from field soils that had received no borax and field soils given borax at rates of 12·5, 25, 50, and 75 lb. per acre, and with boron-deficiency symptoms ranging from severe to almost nil, showed no consistent differences in ash constituents, nitrogen fractions, or carbohydrates, except that reducing sugars accumulated in the roots of the boron-deficient plants.

Microchemical studies demonstrated that boron deficiency was associated with reduction of pectic-staining materials in the intercellular spaces, and later a reduction of cellulose-staining materials.

Anatomical symptoms of boron deficiency generally first appeared in the parenchymatous tissues and vessels in the petioles of the younger leaves. The intercellular substance of the parenchymatous tissue became discoloured, and this was followed by accumulation of a brown gum-like substance in this area. Other symptoms in the tops included plugging of some of the vessels of the petioles and leaf veins with a similar gummy material, changes in the growing point, anthocyanin accumulation in the leaves, and hypertrophy and disintegration of the palisade parenchyma. In the root, boron deficiency produced disintegration of parenchymatous tissue, generally near the xylem, hypertrophy of xylem parenchyma, lack of differentiation of some vascular bundles, restricted growth of secondary roots, and a deposition of gum-like matter in the intercellular spaces of the parenchymatous tissues and in the vessels.

YU (T. F.). **The relation of soil temperature to pathogenicity of Rhizoctonia solani Kühn on Broad Bean seedlings.**—*Nanking J.*, ix, pp. 269–280, 1940.

Rhizoctonia [*Corticium*] *solani* causes severe infection of the hypocotyl and destruction of the plumule of broad beans in Kiangsu, where up to 80 per cent. of the plants may be killed before emergence.

The optimal temperature for infection was determined by growing the plants in non-sterilized garden soil in which had been mixed vigorously growing cultures of the fungus. Infection was found to take place at temperatures ranging from 6° to 31° C. being most severe at 16° to 20°. The optimal temperature for growth of the fungus, as determined by linear growth rate on 1 per cent. potato dextrose agar, was 22° to 28° and the range about 6° to 30°. The optimal temperature for seedling germination, as indicated by the number of seedlings producing roots and hypocotyls, and the average length of the hypocotyl, was found to lie between 26·7° and 28°, and the range to exceed 15·6° to 28°. The author concludes that the effect of increasing temperature on infection is to be explained by an increase in the physiological activities of the host plant, which indirectly restricts the degree of infection, and not by the increased growth rate of the hypocotyl, which is comparatively small for the increase in temperature, markedly reducing infection. Late planting of beans in the affected regions should be avoided.

ALTSTATT (G. E.) & SMITH (H. P.). **Production, diseases, and insects of Garlic in Texas.**—*Circ. Tex. agric. Exp. Sta.* 98, 13 pp., 7 figs., 1942.

Brief, popular notes on the following diseases of garlic in Texas are given in this circular, viz., bulb rots (associated with *Bacillus carotovorus* [*Erwinia caroto-*

vora], *Aspergillus* spp., *Penicillium* spp., *Fusarium* spp., *Diplodia* sp., *Helminthosporium* spp., *Trichoderma* spp., *Sclerotium bataticola* [*Macrophomina phaseoli*], and *S. rolfsii*), mosaic, pink root (*Phoma terrestris* [*R.A.M.*, xii, p. 547], possibly in association with *F. malli* [*F. solani*]), southern blight (*S. rolfsii*), and 'splits'.

Bulb rots can be avoided by making sure that the plants are mature before they are pulled, and sufficiently cured before storage. Storage places should be adequately ventilated, and the containers should be placed so that air can freely circulate about them. If clean bulbs are not obtainable for planting, the cloves should be disinfected before being planted with an organic mercury dust, such as semesan, at the rate of about 3 oz. per bush. or by dipping in a solution of mercuric chloride (1 in 1,000).

Mosaic is becoming increasingly prevalent. Affected plants are small and yield only about 60 per cent. as much as healthy ones. The condition is transmitted with the cloves. Affected plants should be pulled out and destroyed directly the symptoms appear, and, in addition, garlic destined for seed purposes should be grown in a separate block.

Pink root is not serious in the chief garlic-producing areas of Texas. Garlic and onions should not be grown in the same rotation.

Southern blight develops mainly in light, sandy soils. If the fungus is present, root crops, tomatoes, and melons should not be planted in the rotation with garlic.

Splitting of the bulbs generally results from leaving the plants in the soil too long after maturity, with the result that soil organisms attack the outer scales. Growers should reject split bulbs when selecting stock for planting.

LINDFORS (T.). **Bekämpa Lökmöglet!** [Control Leek mildew!]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 2, pp. 1–3, 1943.

In some parts of Sweden, e.g., Gothland and Öland, the ravages of downy mildew [*Peronospora destructor*] have largely frustrated attempts at leek cultivation on a commercial scale. The disease may be combated by spraying with 2 per cent. Bordeaux mixture or Ob 2300, plus a spreader, newly placed on the market by A. B. Lauxein-Casco and known as 'spridex'.

JOHNSON (H. W.) & KOEHLER (B.). **Soybean diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1937, 24 pp., 16 figs., 1943.

Short, popular notes are given on soy-bean diseases in the United States, including bacterial blight (*Pseudomonas glycinea*) [*R.A.M.*, xix, p. 256], bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) [loc. cit.], pod and stem blight (*Diaporthe sojae*) [*D. phaseolorum* var. *sojae*: ibid., xiii, p. 270], frog eye (*Cercospora daizu*) [ibid., xix, p. 256], brown spot (*Septoria glycines*) [ibid., xix, p. 452], anthracnose (*Glomerella glycines*) [ibid., xix, p. 512], downy mildew (*Peronospora manshurica*) [ibid., xxi, p. 361], powdery mildew (probably due to *Erysiphe polygoni*) [ibid., xi, p. 19], leaf spot due to a species of *Alternaria*, arsenical injury, mosaic [ibid., xx, p. 444; xxi, p. 388], chlorosis due to deficiency of potash [ibid., xviii, p. 54], iron, or nitrogen, seed discolorations associated, apparently, with a species of *Cercospora* and *Alternaria*, charcoal rot (*Sclerotium bataticola*) [*Macrophomina phaseoli*; ibid., xix, pp. 254, 260], sclerotial blight (*Sclerotium rolfsii*) [ibid., xix, p. 256], stem rot (*Sclerotinia sclerotiorum*) [ibid., xvi, p. 585; xix, p. 192], *Fusarium* blight (*F. oxysporum* f. *tracheiphilum*) [cf. ibid., xix, p. 256], root rot (*Pythium de Baryanum*) [loc. cit.], *Rhizoctonia* root rot (*R.* [*Corticium*] *solani*) [ibid., xxi, p. 515], *Phymatotrichum* root rot (*P. omnivorum*), and lightning injury.

Up to the present, soy-beans in the United States have remained relatively free from any serious epidemic, except for widespread infection in the south by *Sclerotium rolfsii*. The most conspicuous and widespread diseases are probably

Pseudomonas glycinea and *X. phaseoli* var. *sojense*, while *D. phaseolorum* var. *sojae* is becoming increasingly common in the corn belt states, where it constitutes a distinct menace to production.

Control is dealt with in relation to the diseases considered separately and is also discussed in a final section, in which the planting of resistant varieties [which are indicated] and rotation with forage grasses or cereals are recommended, while it is stated that seed treatments sometimes improve the stand.

Weiss (M. G.). **Inheritance and physiology of efficiency in iron utilization in Soybeans.**—*Genetics*, xxviii, 3, pp. 253–268, 1 pl., 1943.

Marked differences in chlorosis typical of iron deficiency were observed at the Iowa Agricultural Experiment Station in 1938 among soy-bean varieties tested on calcareous soils for the first time since their introduction into the United States from Manchuria. Tests of these varieties in nutrient solution cultures and in sub-irrigated crushed quartz media showed that this differential performance could be induced by growing the plants on media with a low concentration of available iron. On such substrata, varieties which were 'efficient' in iron utilization made normal, green growth, while 'inefficient' ones developed severe chlorosis symptomatic of iron deficiency, ultimately resulting in the death of the plants.

On the basis of F_2 and F_3 populations of crosses between four 'efficient' (Dunfield, Mandell, Klini, and Mukden), and six 'inefficient' (FPI.54619-5-1, FPI.88508, FPI.88358, FPI.88294, FPI.87617, and FPI.88354) varieties, differences in the capacity for iron utilization were shown to be conditioned by a single gene. 'Inefficiency' of F_1 plants from all crosses among the six 'inefficient' varieties established allelism of the recessive gene responsible for the condition, to which the symbol *fe* was assigned, 'efficiency' being represented by *Fe*. The performance of F_1 plants from crosses between 'efficient' and 'inefficient' varieties indicated complete dominance of the *Fe* allele. Analyses of the plant tissues of individuals inheriting 'inefficiency' in respect of iron utilization revealed a relatively higher P_H, lower soluble iron, higher total iron, and lower potassium content.

Pizer (N. H.) & Glasscock (H. H.). **Experiments to determine the effect of certain wood preservatives on the growth and cropping of the cultivated Mushroom (Psalliota campestris).**—*Ann. appl. Biol.*, xxx, 2, pp. 128–131, 1943.

In small-scale laboratory trials with a number of well-known wood preservatives tested for use in mushroom houses, no adverse effect on mycelial growth or on cropping of the cultivated mushroom resulted from wood treatments with 5 per cent. copper sulphate solution, green cuprinol, 5 per cent. celcure solution [*R.A.M.*, xxii, p. 48], or 2 per cent. triolith (Wolman salts) solution. Wood treatments with 2 per cent. chromel salt or coal-tar creosote, on the other hand, reduced the vigour of growth of mushroom mycelium to a depth of $\frac{1}{2}$ in. in compost above the treated wood, although they did not kill the mycelium or reduce the cropping even when the treated wood was only $1\frac{1}{2}$ in. below the casing soil. None of the treatments seemed to inhibit the production of sporophores. It is pointed out, however, that under the conditions of the experiment, where the treated wood was covered with compost, the likelihood of vapours from the wood preservatives coming into contact with sporophores was very small, and that, in general, the possibility of harmful effects from such vapours should not be ignored. The authors conclude that full-scale trials in commercial houses could now be undertaken with copper sulphate, green cuprinol, celcure, and triolith with negligible risk to the crop, but advise further small-scale trials with chromel and coal tar creosote. It is pointed out that owing to the wide range in composition shown by coal tar creosote, the results obtained by the authors with the particular sample of this material used should not be expected to apply to creosotes in general.

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JONES (S. E.). **Control of Eggplant yellows.**—*Bull. Tex. agric. Exp. Sta.* 623, 17 pp., 2 figs., 1942.

Eggplant yellows, an infectious disease apparently caused by a virus, occurs in late summer and autumn in southern and central Texas, and what appears to be the same disease has also been reported from Oklahoma, Louisiana, Florida, and South Carolina. Conspicuous yellow spots appear in the young leaves and rapidly enlarge, often following the veins, until, in about 25 days, all the green chlorophyll is destroyed. The condition first occurs when the plants are eight to ten weeks old; it then rapidly increases. The disease was transmitted by budding within 31 days but not by the insects tested.

Control studies conducted from 1934 to 1939 on 9,092 plants in 54 field plots showed that sulphur, sulphur-pyrethrum, sulphur-cube, fuller's earth-cube, and hydrated lime dusts all gave effective control if applied before infection occurred. Practical control resulted when the plants were kept lightly covered with the dusts during the entire time they were in the seed-bed. Rather better control followed from four or more dustings at intervals of seven to ten days, beginning at transplanting. Almost complete control was obtained when the dusting was carried out both in the seed-bed and after transplanting. When dusting was begun after infection had taken place, the results were unsatisfactory. Soil applications of sulphur at 500 lb. per acre, both in the seed-bed and the field, gave 10 per cent. infection, as against 49·6 per cent. in the controls. Plants grown in the seed-bed in insect-proof cages showed half as much infection as the controls. The most economical form of control consisted in keeping the seed-bed covered lightly with plain dusting sulphur.

FRANCO DO AMARAL (J.). **Estudo do organismo causador da bacteriose da Mandioca.** [A study of the causal organism of a bacteriosis of Cassava.]—*Arq. Inst. biol., S. Paulo*, xiii, pp. 119–125, 2 pl., 1942. [English summary.]

An organism causing a serious vascular wilt of cassava was isolated in pure culture from a planting at Tremembé, São Paulo, Brazil. In inoculation experiments conducted during 1942 with six isolates of the organism, typical symptoms developed in plants of the varieties 'Vassourinha', 'Manipeba', 'Cambaia', and 'Gemedeira' after 11 or 13 days in summer, and after 30 days in winter. The causal organism, an unidentified species of *Phytomonas*, is a Gram-negative, non-sporing, motile rod with rounded ends, 1·6 to 2 by 0·6 to 0·9 μ with monotrichous flagella; in agar it forms round, raised, milky-white colonies, with glistening surface, entire edge, and viscid consistency; in broth it makes abundant growth with dense turbidity and much viscid sediment; it grows well in sugars, without producing acid or gas, completely hydrolyses starch, liquefies gelatine, and digests milk. The organism does not agree in all its characters with any of the known pathogens on cassava.

Wain (R. L.) & Wilkinson (E. H.). **Investigations with various copper compounds in relation to 'damping-off' in Peas.**—*Rep. agric. hort. Res. Sta. Bristol, 1942*, pp. 59–64, [1943].

This is an expanded account of studies conducted at Long Ashton on the control of damping-off of peas, a preliminary note on which has already been noticed [*R. A. M.*, xxii, p. 191].

Kehl (H.). **Zur Keimungsphysiologie der Champignonsporen.** [A contribution to the physiology of Mushroom spore germination.]—*Gartenbauwiss.*, xvii, pp. 156–170, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 16, p. 1683, 1943.]

Mushroom [*Psalliota* spp.] spores must be sterilized to induce germination, and thanks to their exceptionally solid walls no appreciable reduction of viability is caused by the application of disinfectants, of which chloroform proved to be the most effective in tests at the Geisenheim (Rhine) Viticultural and Horticultural Research Institute. Four hours' treatment with chloroform sufficed for total sterilization, while the germinative capacity of the spores was not impaired even by several days' immersion. An acceleration of up to five days in germination was secured by this method of disinfection. Carbohydrates are indispensable to spore germination, which occurred within a P_H range of 3·5 to 7.

De Zeeuw (D. J.). **A method for obtaining single-spore cultures of Agaricus campestris.**—*Phytopathology*, xxxiii, 6, pp. 530–531, 1943.

A large number of uncontaminated spores of *Agaricus* [*Psalliota*] *campestris* were smeared on an agar slant with a sterile brush and allowed to germinate and grow for one to two weeks. When a solid mycelial mat had formed, the culture was killed by immersing the tube in boiling water. The dead mycelial mat was then aseptically removed, and the sterile medium used for hanging drops on cover slips over Van Tieghem cells. From 30 to 50 per cent. of the single spores of two commercial varieties of mushroom isolated and placed on this medium germinated in replicated tests. When 100 single spores were isolated and placed on unstaled medium, only about 5 per cent. germinated.

Williams (P. H.), Sheard (Enid), Selman (I. W.), & Read (W. H.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1942*, pp. 27–47, 1943.

In this report [cf. *R.A.M.*, xxii, p. 8] P. H. Williams discusses his experiments on testing the resistance of tomato seedlings to *Verticillium albo-atrum* and *V. dahliae* by sowing seeds in steamed soil, removing the seedlings when they showed two rough leaves, and dipping the roots in a liquid culture of the fungus, after which the plants were potted up in sterilized soil. Four weeks after potting, the plants were cut off at soil-level, and the total number of leaves and the number of dead and yellow leaves were counted.

When Ailsa Craig, Manx Marvel, and Riverside tomato plants were inoculated with *V. albo-atrum* and strain V. 243 (possibly *V. dahliae* or a saltant of *V. albo-atrum*), the mean percentages of dead and yellow leaves were, respectively, 34·2, 22·9, and 21·2 for the former fungus, and 35·8, 35·7, and 31·2 for the latter. Analysis of the data demonstrated that Manx Marvel and Riverside showed significantly less disease than Ailsa Craig when inoculated with *V. albo-atrum* and no difference when inoculated with V. 243. Ailsa Craig was attacked equally by both fungi, and Manx Marvel and Riverside were significantly less resistant to *V. albo-atrum* than to V. 243.

During July and August, Vetomold tomatoes attacked by *Cladosporium fulvum* [ibid., xxi, p. 172; xxii, p. 81] were received from several sources. Plants raised

from two samples of Vetomold seed sent in by a grower, one being the original strain supplied to him in 1940, and the other a strain obtained by him direct from the Vineland Station in 1941, and from Cheshunt seed of Ailsa Craig and Vetomold were sprayed with spores from the imported Vetomold leaves, and about one month later all showed infection. Later, the strains of Vetomold and Ailsa Craig were sprayed with spores from leaves from a greenhouse at Cheshunt and also with spores imported with the original specimens of Vetomold. Both strains of Vetomold inoculated with the fungus from Vetomold became infected. The Vetomold plants sprayed with the Cheshunt spores remained unaffected. Ailsa Craig was attacked in both cases. It appears that a strain of *C. fulvum* able to infect Vetomold is present in England.

Studies by I. W. Selman showed that when Potentate tomato plants were inoculated with tomato mosaic when the first truss was in bloom the best yield was obtained from plants grown without the addition of fresh lime (though old lime residues were present), but with the addition as a base dressing of 1 oz. sulphate of potash per 10 in. pot. A yield (mean of 16 plants) of 5 lb. 5 oz. per plant was obtained, of which 3 lb. 10 oz. consisted of unblemished ripe fruit. Uninoculated controls with similar manurial treatment yielded 6 lb. 5 oz. per plant (5 lb. 3 oz. unblemished). Evidently, it is possible to secure profitable crops by 'growing on' mosaic tomato plants, even when infection occurs at a very early stage. Roguing such plants is uneconomic, particularly in war.

E. Sheard states that in 1941 numerous specimens were received of outdoor tomatoes of Stonor's varieties showing pale brown, irregular spots, with a well-defined margin, and ranging in size from small spots to blotches covering one-third of the surface of the fruit. The lesions were not uniformly brown, but had the appearance of a darker brown network on a pale ground. No organism was isolated, and it was concluded that the defect was possibly due to weather conditions.

W. H. Read, after pointing out that no satisfactory method of controlling tomato stem rot (*Didymella lycopersici*) has yet been devised, describes the results obtained from attempts to kill the fungus on the plants, to destroy it in the soil, and to apply protective fungicides to the plants. Cutting out lesions on the stem above soil-level and painting the wounds with a fungicide proved useless. Infected soil was sterilized by heating to 122° F. for 10 minutes, and it is considered that this method should destroy the fungus under glasshouse conditions. In the laboratory, 48 hours' contact with formaldehyde (1 in 1,000), cresylic acid (1 in 850), and a proprietary emulsion of tar acids of higher boiling point than cresylic acid (1 in 430) destroyed the fungus. *D. lycopersici* appeared to be highly resistant to fungicidal action in the presence of plant juice. When a spore suspension was placed on a wound freshly made with a sharp knife and immediately treated with pastes of Bordeaux mixture, 5 per cent. lime-sulphur, flowers of sulphur, or lime, infection often resulted.

In tests of the control of *Phytophthora infestans* on tomatoes by various fungicides, though no infection developed, probably as a result of the weather conditions that prevailed, it was found that Bordeaux mixture of various strengths and cuprous oxide sprays hardened the plants; while Burgundy mixture (10–12½–100) caused considerable leaf scorch and left a heavy deposit on the fruit.

Italy: phytopathological observations.—*Int. Bull. Pl. Prot.*, xvii, 5, pp. 69M–70M, 1943.

The following information has been received from Royal Italian Cryptogamic Laboratory, Pavia. Wheat roots are subject to infection by at least two species of *Pythium*, one of which is prevalent and widely distributed, *Olpidiaster radicis* [*Olpidium brassicae*: *R.A.M.*, xviii, p. 821], *Ligniera* (*Sorosphaera*) *graminis* [cf. ibid., xii, p. 468], and *Phytophthora* sp.

A *Trichothecium* allied to *T. roseum* was isolated from the conidiophores of *Plasmopara viticola* on vine leaves, but attempts to induce the parasitization of the latter by the former were unsuccessful. The alleged suppression of the downy mildew fungus by *T. plasmoparae* in France [ibid., xi, p. 693] is thought rather to represent a kind of symbiosis between the pathogen of the higher plant and a saprophyte or hemi-saprophyte attacking the decaying organs of the host.

Samples of date palm from Libya showed infection by *Mauginiella scaettae*, the suggested inclusion of which in the genus *Geotrichum* [ibid., viii, p. 565] is not accepted on account of differences in (*a*) the mode of arthrospore disarticulation, effected in *M. scaettae* by the fragmentation of the very long cells, consisting of two to 40 elements, and (*b*) pathogenic characteristics. Material from the same source was also infected by smut (*Aspergillus phoenicis*).

Cronartium asclepiadeum caused severe damage to Austrian pine [*Pinus nigra*] in the Massa region of Tuscany.

Sixteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1942.—74 pp., 1942.

This report from Australia [cf. *R.A.M.*, xxi, p. 405] contains, *inter alia*, the following items of interest. In further studies on wheat take-all (*Ophiobolus graminis*) [ibid., xxi, pp. 519, 520; xxii, p. 295], greenhouse experiments showed that while disease symptoms appeared in the ears of all inoculated plants, and while yield was significantly less in these than in the control plants, whiteheads developed only in dry soil conditions. Out-of-doors, significant differences were noted between crops grown (in drums) in soil alone and those grown in soil containing large quantities of burnt lime, though plants grown in soil to which large or small amounts of ground limestone or calcium sulphate were added were no better than the controls.

Contributory factors in the die-back or decline in apple trees, which in recent years has become increasingly prevalent on the lighter soil types in Tasmania, are soil erosion, excessive cultivation, ploughing too close to the trees, and unsatisfactory manuring; the detrimental effects of these have been aggravated by a succession of dry seasons.

Studies of the storage qualities of apples from trees on different rootstocks again showed that fruit from Malling VII rootstock had low, and that from Malling II high susceptibility to pit and breakdown; other stocks were intermediate. In surface-coating experiments, very little difference was found between the castor oil-shellac-alcohol bath and various wax emulsion coatings, as regards effectiveness, but the solutions had the practical advantages of durability and rapid drying. Treatment retarded colour change and reduced both shrivelling and Jonathan spot incidence. Storage pit and lenticel scald were also reduced, or, at least, the appearance of these disorders was delayed. With Sturmer apples, susceptibility to brown heart and alcoholic flavours increased rapidly with maturity. This variety should not be treated after the first week in May.

Experiments by the Victorian Department of Agriculture showed that yields of 200 lb. ergot [*Claviceps purpurea*] per acre [cf. ibid., xxi, p. 135] can be obtained if the rye is sown early in suitable districts, and proper methods for insuring high infection are followed. Satisfactory mechanical methods of separating the ergot have not yet been devised [ibid., xxii, p. 301], and hand-picking is uneconomic, unless the market price of ergot is very favourable.

A stock of Up-to-Date (Factor) potatoes free from virus X [ibid., xx, pp. 220, 592] was isolated during the previous season and is being multiplied, as is a stock of Tasmanian Bismarck, which is similarly free. Spotted wilt [ibid., xxii, p. 173] has become increasingly important in the potato crops in some areas,

and the most urgent question is whether the virus is transmitted through the tubers.

In the cold, wet conditions prevailing during the 1941 sowing period at Orbost, Victoria, treatment of commercial maize seed [against *Diplodia zeae*: ibid., xxi, p. 405] with agrosan gave a 38 per cent. increase in establishment and one of about 20 per cent. in yield. Peas or vetches [*Vicia* spp.] ploughed in as green manure about two months before sowing maize increased the yield, but oats similarly used as manure did not. The percentage of basally rotted stalks at harvest was greater in maize following the green manure crops than in maize following oats or without green manure, though the ears on the basally rotted stalks were seldom reduced in size. The percentage of rotted ears did not appear to be decreased by green manuring. Soil drought at or after tasseling reduced the severity of maize ear rot but increased that of localized stalk rot.

Lupinus varians was attacked by the common pea mosaic virus. The disease is present throughout the lupin-growing areas, wherever peas are grown near the lupins, but it appears to be economically unimportant. In the Perth area, the common garden shrub *Cassia corymbosa* was ascertained to be a host of the virus, in which it carried over during summer. To control the disease in the experimental lupin plots, householders in the vicinity were asked to remove affected *C. corymbosa* shrubs from their gardens, and grow only those pea varieties that are known to be immune from pea mosaic.

Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 6, pp. 267–270, 3 figs., 1 graph, 1943.

Leaf curl of stone fruits ([peach] and nectarine) caused by *Taphrina deformans* [*R.A.M.*, xxi, pp. 147, 338] is stated to be readily controllable by spraying before bud-burst (preferably while the blossom buds are swelling) with Bordeaux mixture (6–4–40) or lime-sulphur 1 per cent. When conditions favour infection, Bordeaux mixture is slightly more effective than lime-sulphur; it is also more durable. If spraying has to be carried out before the buds swell, Bordeaux mixture is preferable. If lime-sulphur is used before bud swell and showers are experienced, the application must be repeated at a late stage of bud swell.

Grape black spot or anthracnose (*Elsinoe ampelina*) [ibid., xxi, pp. 319, 480] can be controlled by spraying with Bordeaux mixture (6–4–40) or lime-sulphur 1 in 8 just before bud-burst. A further application of Bordeaux mixture (6–4–50) should be made when the shoots are about 6 in. long. If the weather conditions favour infection two more applications should be given (at the 6–4–50 concentration), one just before blossoming and the other as soon as the fruit has set.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 5, pp. 267–272, 7 figs.; 7, pp. 365–370, 9 figs., 1943.

Club root (*Plasmodiophora brassicae*) [*R.A.M.*, xx, p. 507; xxi, p. 442] of crucifers has been established for many years in some of the chief vegetable-growing areas of Victoria. It is mostly confined to localities with a heavy soil, and seems to be most prevalent in the Werribee Irrigation Settlement. In heavily infected soil the cultivation of crucifers should be abandoned for at least five years. Other control methods suggested consist in the application of agricultural lime at the rate of 1 to 2 tons per acre several months before planting, and watering the seed-beds at sowing and when the plants are 2 in. high with mercuric chloride 1 in 2,000. Clean cultivation to suppress weeds and the destruction by burning of diseased refuse are also recommended.

Collar rot [*Phytophthora* ? *citrophthora*: ibid., xvi, p. 169] is one of the most serious diseases affecting citrus trees in Victoria. The usual control measures are recommended.

Brown rot (*Sclerotinia fructicola*) of stone fruits has caused serious losses in Victoria during the past twenty years. Under certain conditions, infected fruits, which have fallen from the tree and been left lying on the ground, may produce apothecia. These bodies have been found in the Goulburn Valley, Victoria, and, if conditions are favourable to infection, blossom infection may result. Fallen fruits should be disturbed by ploughing or cultivating before the trees flower, and the angular strips within a few inches of the butt of the tree, which are often left undisturbed after ploughing, should be cultivated by hand. All stone fruit trees should be sprayed with Bordeaux mixture (6–4–40) as the buds swell in spring; peaches, plums, and cherries should be sprayed at the very early bud-burst stage. Apricots previously attacked by brown rot should be sprayed at the pink- and pink-white bud stages. Peach, plum, and cherry fruits may be treated with a dry-mix spray consisting of 16 lb. air-blown sulphur, 8 lb. fine-grade hydrated lime, and 1 lb. lime casein spreader, used at the rate of 25 lb. per 100 gals. water. This spray should be applied periodically after the fruit has formed, and during its subsequent development, but not during the six weeks preceding maturity, except on canning peaches, as the deposit detracts from the appearance of the fruit. Sulphur sprays should not be used on apricot fruits.

Experiments on the control of apricot scab (*Clasterosporium carpophilum*) showed that under the conditions prevailing in the Goulburn Valley thorough spraying with Bordeaux mixture (6–4–40), applied when the last leaves are falling and again at the pink-bud stage, reduced infection from 77 to 2 per cent.

The control of diseases of fruit trees caused by fungi that attack the trees through pruning and other wounds due to mechanical agency, including *Polystictus* spp., *Stereum purpureum*, and *Verticillium* sp., consists in trimming all wounds over ½ in. in diameter and then covering them with bituminous or white lead paint. If infection develops, the limb should be removed beyond the last sign of diseased tissue.

1942 disease information for the Middle Atlantic States.—*Plant Dis. Reptr Suppl.* 140, 49 pp., 1943. [Mimeographed.]

Notes are given on diseases of cereal and forage crops, fruits, ornamental plants and turf, potatoes, tobacco, and truck crops occuring during 1942 in the Middle Atlantic States. The information was assembled at the request of the chairman of the Middle Atlantic States Section of the American Phytopathological Society War Emergency Committee, R. S. Kirby, to supply plant pathologists with facts valuable for the planning of future research.

Principales enfermedades parasitarias que fueron objeto de consulta en el primer semestre de 1942. [The principal parasitic diseases which were the object of consultation during the first half of 1942.]—*Bol. Sanid. veg., Santiago*, ii, 1, 2 unnumbered pages between pp. 60 and 69, 1942.

Among the parasitic plant diseases investigated during the first half of 1942 by the phytopathologists attached to the Chilean Ministry of Agriculture [cf. *R.A.M.*, xxii, p. 241] were *Cycloconium oleaginum* on olive, *Peronospora* [*Plasmopara*] *halstedii* on sunflower, *Sphaeropsis pinastri* [*Diplodia pinea*] on *Abies pinsapo*, and *Tranzschelia* [*Puccinia*] *pruni-spinosae* on peach.

Henry (B. W.), Riker (A. J.), & Duggar (B. M.). **Thiamine in crown gall as measured with the Phycomyces assay.**—*J. agric. Res.*, lxvii, 3, pp. 89–110, 1 fig., 1 graph, 1943.

The relation of thiamin to crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) development [*R.A.M.*, xxii, p. 346] was studied in Wisconsin, using the *Phycomyces* assay [ibid., xv, p. 169] for all thiamin determinations and glycine as the

nitrogen source. In inoculation experiments with greenhouse and field tomatoes, greenhouse sunflowers, and field marigolds, it was found that thiamin concentrations were consistently higher in crown-gall tissue than in mature stem tissue of the same plant or of the uninoculated control. Almost the maximum concentration of thiamin was present at inoculation points within one week of inoculation and before visible galls developed; the concentration remained fairly constant during the period of rapid increase of gall size. It is suggested that the higher concentration of thiamin in crown galls as compared with mature stem tissue of inoculated or uninoculated plants is probably due, in the early stages of gall development, more to the presence of the crown-gall bacteria than to the meristematic nature of gall tissue. Bacteria from a partly attenuated culture contained more thiamin than those from a virulent culture and the minute galls produced by the former contained as high a concentration of thiamin as the large ones produced by the latter. There is no evidence that thiamin plays a causal part in crown-gall initiation or development beyond that of any essential food or growth factor present in that area of meristematic activity.

Baker (R. E. D.). **Witches' broom disease investigations. IV. Further notes on the susceptibility of I.C. selections at River Estate to witches' broom disease of Cacao.**—*Trop. Agriculture, Trin.*, xx, 8, pp. 156–158, 1943.

Further observations on the susceptibility to witches' broom [*Marasmius perniciosus*: *R.A.M.*, xxii, p. 242] of certain I.C. cacao selections at River Estate, Trinidad, showed that between March, 1942, and March, 1943, the disease had become considerably worse. By the latter date loss of pods was serious in this field for the first time. Among the first set of trees, I.C.S. 6 and 8 were still the best as regards the number of brooms. Among the second, I.C.S. 7 and 22 remained in the best group, with about half as many brooms as I.C.S. 53, while I.C.S. 45 came in the best group as regards total brooms. Among the third set, I.C.S. 2, 9, and 98 showed some resistance, the last two being of considerable promise. So far the best clones appear to be Nos. 6, 8, 9, 45, and 98.

Andrén (F.). **Några betningsresultat.** [Some disinfection results.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 4, pp. 5–10, 1943.

Cereal seed-grain disinfection experiments were carried out as usual in Sweden during 1942 [cf. *R.A.M.*, xxii, p. 164], the results presented in this tabulated account, however, being confined to field trials with commercial preparations. The average increase in the winter wheat crop from the various treatments against bunt [*Tilletia caries* and *T. foetida*] is estimated at 12·4 per cent., the differences in efficiency between the individual plant-protectives not being deemed significant. A similar observation was made in respect of the treatments used for the control of snow mould (fusariosis) [*Calonectria graminicola*] of rye, the average increase in yield of which was computed at 7·1 per cent.; the attack was very mild. The barley crop was heavily infected by stripe disease [*Helminthosporium gramineum*], and the treated seed yielded on an average 18·9 per cent. more than the untreated: here again, however, there was no significant difference between the various preparations in toxicity to the pathogen. The discrepancies in the results obtained with the different fungicides in the oats loose smut [*Ustilago avenae*] tests are to some extent attributable to the partial use of the 'evacuation' method of inoculation [ibid., xxii, p. 300], in which the mycelium penetrates much deeper than in the case of spontaneous infection and is correspondingly harder to eliminate. Very satisfactory control was nevertheless effected by dusting with betoxin 61 and fusariol (300 gm. per 100 kg.) and immersion in 0·25 per cent. uspulun for one hour or 15 minutes in 0·1 per cent. mercuric chloride-formalin, the last-named giving almost absolute freedom from smut.

Gassner (G.). **Beiträge zur Giftwirkung der Quecksilberalkyle.** [Contributions to the toxic action of the mercury alkyls.]—*Phytopath. Z.*, xiv, 4, pp. 385–389, 2 graphs, 1943.

The results of further tests with methyl mercury chloride, methyl mercury bromide, and methyl mercury iodide confirmed those of previous experiments by the author and Ilse Esdorn [*R.A.M.*, ii, p. 557] in regard to the fungicidal efficiency and highly favourable chemotherapeutical index (0·1) of these compounds. At a concentration of 1 in 500,000, for instance, one hour's immersion in any of the three virtually inhibited the germination of barley covered smut [*Ustilago hordei*] spores, while at 1 in 200,000 and upwards viability was totally destroyed. At the same time, no appreciable reduction in wheat seed-grain germination was caused by any of the compounds at or below 1 in 50,000.

General seed treatment recommendations for field crops.—*Plant Dis. Reptr*, xxvii, 9, pp. 202–203, 1943. [Mimeographed.]

This list of chemicals recommended for treatment of cereal seed is reprinted from a mimeographed leaflet issued by the War Committee of the American Phytopathological Society, 23rd March, 1943. Arasan and spergon are not recommended for use at present.

Mundkur (B. B.). **Studies in Indian cereal smuts. V. Mode of transmission of the Karnal bunt of Wheat.**—*Indian J. agric. Sci.*, xiii, 1, pp. 54–58, 1943.

Pot experiments have been in progress since 1938 with the object of determining the mode of transmission of the 'Karnal' bunt of wheat, caused by *Neovossia indica* [*R.A.M.*, xx, p. 179], which is prevalent in the Punjab and North-West Frontier Province, and may occur in the north-western districts of the United Provinces. Healthy seed was sown in heavily infested soil and bunted seed in both disease-free and severely infested soil, in the latter case at different depths, while plants raised from diseased seed in contaminated soil were cut back to induce tillering in the hope that symptoms would develop in the tillers. Only three bunted ears were formed in the infested pots throughout the whole course of the trials, a similar observation, however, being likewise made in the controls. These few cases are presumably attributable to natural infection, the manner in which this takes place being still obscure.

Holton (C. S.) & Suneson (C. A.). **Wheat varietal reaction to dwarf bunt in the western Wheat region of the United States.**—*J. Amer. Soc. Agron.*, xxxv, 7, pp. 579–583, 1943.

The reaction of 52 varieties and hybrid selections of winter wheat to dwarf bunt [*Tilletia caries*] was determined by nursery tests in five localities in Washington, Idaho (two), Utah, and Montana [*R.A.M.*, xxi, p. 133], healthy seed being sown in soil presumed to be contaminated by spores of the smut. Thirty-one of the varieties, including Relief, Rex, Requa, Hymar, Minturki, Albit, and Redit, showed less than 10 per cent. bunt, so that ample highly resistant stock is available for breeding purposes; among the remainder the incidence of infection ranged from 11 per cent. in C.I. 11924 to 76·5 per cent. in Elgin, other susceptible varieties including Oro, Kharkof, Turkey (C.I. 6175), Rio, Carlson's Fife, Hybrid 128, Yogo, and No Name, with 22·5, 33·9, 37·8, 42, 48·7, 59, and 70·5 per cent., respectively. The maximum amount of infection developed at Logan, Utah, and the minimum at Troy, Idaho; these differences may be due to the physiologic races of the dwarf bunt organism present or to environmental factors influencing infection. Conflicting results were shown by Oro, due perhaps to the aggressive ordinary bunt suppressing the development of dwarf bunt at one locality.

PUGSLEY (A. T.). **Varietal resistance of Wheat to loose smut.**—*J. Aust. Inst. agric. Sci.*, ix, 2, pp. 86–88, 1 fig., 1943.

Inoculation experiments carried out in South Australia in 1941 and 1942 showed that the following wheat varieties were completely resistant to loose smut (*Ustilago tritici*), the inoculum being derived from a single plant in 1940, and maintained on several varieties since: Khapli, Doubbi, Ford, Dundee, Totadgin, Rapier, Koala, Hope, Gular, Gluyas, Bordan, Pusa 4, Noongar, Baart 38, and White Federation 38. These varieties are, however, likely to react differently towards other races of the fungus. The susceptibility of other test varieties [which are tabulated] varied up to 82 to 100 per cent. infection in different rows of Dindiloa.

BARRUS (M. F.). **Yellow-spot disease of Wheat in New York State.**—*Plant Dis. Reptr*, xxvi, 11, pp. 246–247, 1942. [Mimeographed.]

The yellow spot disease of wheat, believed to be a new record for the United States, was observed in 1943 in several counties of New York State. The causal fungus was identified by A. G. Johnson as *Helminthosporium tritici-vulgaris* [*R.A.M.*, xvi, p. 664].

In a note, A. G. JOHNSON reports that the above disease has been found to occur abundantly in a winter wheat nursery and to some extent also in commercial fields of winter wheat in Maryland. It is suggested that the disease has probably been present for some time past, but has been confused with that caused by *H. sativum*. The leaf spots caused by *H. tritici-vulgaris*, particularly when they are small, have yellower margins and lighter brown centres than those caused by *H. sativum*.

SUNESON (C. A.) & SANTONI (SYLVIA C.). **Barley varieties resistant to stripe, Helminthosporium gramineum Rabh.**—*J. Amer. Soc. Agron.*, xxxv, 8, pp. 736–737, 1943.

In preliminary experiments in California in 1942 and 1943 on the reaction to stripe (*Helminthosporium gramineum*) of 14 varieties of barley, the F_1 progeny of crosses with male-sterile plants were dusted with spores of the fungus immediately following mass pollination [*R.A.M.*, xxi, p. 445]. The degree of resistance of Vaughn, Arivat, Wisconsin Barbless, Trebi, Coast (Winter Tennessee), and Hannchen was sufficient to permit their war-time cultivation without seed treatment, if the proper dusts are not available. These varieties, with the exception of Wisconsin Barbless, are at present cultivated over about 1,000,000 acres in California and the bordering States. Three genetic groupings are suggested by the F_1 performance of the hybrids under observation: (1) resistant, with dominance nearly complete, (2) intermediate resistance or incomplete dominance, and (3) susceptible or dominance of susceptibility.

BOYD (A. E. W.). **The necessity for annual seed disinfection.**—*Scot. J. Agric.*, xxiv, 3, pp. 174–176, 1943.

The author describes an experiment on the control of leaf stripe (*Helminthosporium avenae*) [*R.A.M.*, xxii, pp. 128, 201], in which Star oats seed-grain was treated with disinfectant dusts A, B, and C and sown in pots and in the field. Estimates were made of the percentage braird (i.e., the number of seedlings that become established) and leaf stripe. Samples of the seed from the field plants were sown in pots in the following year, without disinfection, braird and leaf stripe estimates again being made. In the first pot test the grain treated with A, B, and C dusts and the untreated control gave, respectively, 94, 95, 109, and 100 per cent. braird, 0, 0, 0, and 63 per cent. leaf symptoms, and 21, 33, 19, and 90 per cent. coleoptile symptoms. In the field test the corresponding figures were 159, 160, 124, and 100 per cent. braird and 0, 1, 0, and 32 per cent. leaf symptoms. In the final test

they were 131, 110, 121, and 100 per cent. braird, 40, 40, 36, and 38 per cent. leaf symptoms, and 96, 96, 94, and 98 per cent. coleoptile symptoms. These figures show that seed treatment decreases leaf stripe and improves braird and crop, but does not protect the resulting seed from infection, which arises from wind-blown spores. Seed disinfection must be carried out every year, even if the seed comes from a crop grown from disinfected seed.

GODWIN (H.). **Biological flora of the British Isles. Rhamnaceae : Rhamnus cathartica L., Frangula alnus Miller (Rhamnus frangula L.).**—*J. Ecol.*, xxxi, 1, pp. 66–68, 1943.

A. SMITH contributes the section of this paper dealing with the fungi observed on *Rhamnus cathartica* and *R. frangula* in the British Isles. Both species serve as hosts of the aecidial stage of *Puccinia coronata* [*R.A.M.*, xvii, p. 737]. *Stereum purpureum* was associated with foliar silvering of *R. frangula* at Wicken Fen, Cambridgeshire. R. E. D. Baker (*J. Ecol.*, xxiv, pp. 110–112, 1936) established the pathogenicity of *Nectria cinnabarina* and *Fusarium* sp. in connexion with a die-back of the same host, while unpublished observations by F. T. Brooks further suggest the implication of a species of *Cytosporina* in the etiology of the trouble. A list is given of the remaining known fungal occupants of both *R.* spp., which are believed to be in the main saprophytic.

RAYSS (T.) & HABELSKA (H.). **Rhamnus palaestina Boiss.—a new host of crown rust.**—*Palest. J. Bot.*, J Ser., ii, 4, p. 250, 1942.

In April, 1942, a shrub of *Rhamnus palaestina* in the Judean mountains was found to be heavily infested by the aecidial stage of *Puccinia coronata* [cf. preceding abstract]. Inoculation experiments with aecidiospores from this source on a number of Gramineae gave positive results only on *Avena barbata* and *Phalaris minor*, on which the teleutospores of the rust developed after 17 days and a month, respectively. *R. palaestina* is a new host for *Puccinia coronata*, but its part in the dissemination of the disease is unlikely to be important, since in Palestine *P. coronata* overwinters in the uredo stage. A rust, probably *P. coronata*, was also observed in the spring of 1942 on *R. alaternus* in the Jerusalem Botanic Garden.

ULLSTRUP (A. J.). **Diseases of Dent Corn in the United States.**—*Circ. U.S. Dep. Agric.* 674, 34 pp., 22 figs., 1943.

This paper contains much useful information, presented in a semi-popular form, on the symptoms, etiology, distribution, and control of maize diseases in the United States, including a leaf spot caused by an undetermined *Helminthosporium* stated to consist of two races, of which I resembles *Cochliobolus heterostrophus* and is confined to the inbred lines Pr, K61, and K44, while II produces narrow, irregular, chocolate-coloured spots on the leaves, which are, however, seldom attacked. Both races invade the ears, forming a black, mouldy growth over the kernels.

WALKER (E. A.) & MAGRUDER (J. W.). **Maryland field Corn leaf blight disease survey—1942.**—*Plant Dis. Reptr*, xxvii, 5–6, pp. 126–135, 1943. [Mimeographed.]

Data from a field survey of maize leaf blight (*Phytomonas* [*Xanthomonas*] *stewarti* and *Helminthosporium turcicum* [*R.A.M.*, xxii, p. 383] here assessed together as one disease) made in Maryland following a severe epiphytotic in 1942, showed that no hybrid or open-pollinated variety was immune, although some were more resistant than others. In general, early-planted and short-season varieties were more severely affected than were the late-planted or long-season ones. The average infection ranged from 87·2 to 20 (mean average 45) per

cent. in the hybrids, and from 38·8 to 29·2 (mean average 35·8) per cent. in the open-pollinated maize, the average infection for all varieties being 43·5 per cent. Among the hybrids, Funk G 135 and Kentucky Y 102 showed least leaf injury, while Pioneer 332 and 300 showed most; among the open-pollinated varieties Lancaster Sure Crop had the least and Golden Queen the most injury. The greatest frequency of leaf blight was within the range of ·40 to 50 per cent. for hybrids, and one of 30 to 40 per cent. for all maize. Following the leaf blights, ear rots of maize were more prevalent than usual, and particularly on open-pollinated varieties: *Diplodia zeae* was about eight times more abundant than *Gibberella zeae*.

HOPPE (P. E.). **Comparison of certain mercury and non-metallic dusts for Corn seed treatment.**—*Phytopathology*, xxxiii, 7, pp. 602–606, 2 figs., 1943.

Particulars are given of preliminary trials at the Wisconsin Agricultural Experiment Station on the comparative merits of spergon (tetrachloro-para-benzoquinone), thiosan (50 per cent. tetramethyl thiuramdisulphide), new improved semesan jr. (1 per cent. ethyl mercury phosphate), and barbak D (not less than 6 per cent. mercuric phenyl cyanamide), for the control of the form of maize seedling blight caused by *Diplodia zeae*. In laboratory tests, in which surface-sterilized rotted kernels were dusted with the fungicides before transference to potato dextrose agar plates, spergon proved definitely inferior to the other three about equally effective preparations. The bulk of the kernels in all the treatments ultimately developed infection, but the percentage of those remaining healthy was highest in the semesan jr. series. In the field experiments (unavoidably omitting thiosan), new improved ceresan again gave the best results with 100 per cent. infected seed, the stand percentages for this fungicide, barbak D, spergon, and control being 91·1, 77·8, 40, and 24·4, respectively, and the figures for the corresponding treatments of 71 nearly disease-free inbred lines 84·5, 82·1, 85·4, and 79·8, respectively. Spergon appears to have equalled the mercury dusts in protecting the seed from soil infection, but it induced stunting in comparison with semesan jr. or barbak D and did not prevent the mesocotyls from becoming badly diseased.

HOPPE (P. E.). **Fusarium ear rot in Sweet Corn.**—*Plant Dis. Reptr*, xxvi, 21, p. 458, 1942. [Mimeographed.]

An epidemic of *Fusarium* ear rot (*Gibberella fujikuroi*) was observed in September, 1942, near Lodi, Wisconsin, in a field of Golden Cross Bantam sweet corn. The field had been planted in June, on a low but rich piece of land, and there had been frequent rains. Infections had developed in wounds following extensive pericarp cracking. The disease had spread rapidly from the numerous local infections, with the result that most of the ears had from one to several mouldy blotches an inch or more in diameter by the time the crop was ready. The whole field was rejected by the canners.

KOEHLER (B.). **Disease threatening Broom Corn production in Illinois.**—*Plant Dis. Reptr*, xxvii, 2, pp. 70–73, 1943. [Mimeographed.]

During 1941 and 1942 severe damage was caused to broomcorn [sorghum] in Illinois by a disease apparently due to *Colletotrichum graminicola* [cf. *R.A.M.*, xv, pp. 280, 494, 795]. The condition seemed to combine the features of leaf-spotting, root rot, and stalk rot. The root- and stalk-rot phase, which is the serious one, often originates in a break in the outer sclerenchyma, this making a weak place where infection starts. Once infection has entered the stalk, it spreads rapidly through the vascular tissues, frequently reaching the brush. The diseased areas turn red. The lower part of the stem becomes hollow, and masses of mycelium are often visible within. The first sign that the stalks are dying is a blanching

of the upper part, which occurs before or after the brush emerges. As the stalk dies it very often breaks over near the ground. By the time this happens numerous reddish-brown streaks or blotches have developed on the stem surfaces, the larger ones with grey centres, the result of the fungus coming to the surface from the interior. Spores are borne on these blotches. Similar blotches and spores on the leaves probably result from local infections. *C. graminicola* has caused a leaf spot of sorghum in Illinois for many years, but the present epidemic may be due to a new strain or race. In preliminary inoculation experiments with plants of the Black Spanish variety, 30 per cent. finally broke over.

Martin (W. J.). **A study of the genetics of Sorosporium syntherismae and Sphacelotheca panici-miliacei.**—*Phytopathology*, xxxiii, 7, pp. 569–585, 4 figs., 1 graph, 1943.

The collections of *Sorosporium syntherismae* used in this study were obtained from two of its common hosts, *Panicum capillare* and *Cenchrus pauciflorus*, while the isolate of *Sphacelotheca panici-miliacei* originated on *P. miliaceum* [*R.A.M.*, xxi, p. 20]. The life-cycle and nuclear condition of the two species conform to those of the smuts in general, the sporidia being haploid and potentially gametic, infection occurring in the seedling stage of the host, the parasitic phase being dicaryotic, the mature chlamydospores diploid, and the reduction-division taking place during the germination of these organs.

The material of the two smuts at the author's disposal definitely represents distinct species, differing in sorus type as well as in the size, arrangement, and markings of the chlamydospores. The results of cross-inoculation experiments showed that *S. panici-miliacei* attacked only *P. miliaceum*, whereas *Sorosporium syntherismae* was pathogenic both to that species and *P. capillare*. Zundel reported [ibid., xix, p. 120] that some of his supposed collections of *Sphacelotheca panici-miliacei* on *P. miliaceum* closely resembled *Sorosporium syntherismae*, and from the writer's investigations it seems probable that they actually did belong to the latter species, or they may have been hybrids between the two smuts under discussion, which are roughly intermediate between the two parents in such characters as sorus type, spore dimensions and arrangement, spore wall reticulations, time required for spore germination, and pathogenicity. Spore size and wall markings are controlled by different factors, which appear to be independently inherited: the factor for verruculose spore walls behaves as a simple dominant over that for the smooth type. Less than 10 per cent. of the F_1 hybrid sporidia were viable. The interspecific dicaryophytes produced by hybridization between *S. syntherismae* and *Sphacelotheca panici-miliacei* were capable of infecting both *P. miliaceum* and *P. capillare*, the lines arising from different combinations varying in their pathogenicity, e.g., on the White Ural variety of *P. miliaceum* from 8·6 to 84·9 per cent.

Keast (J. C.). **Copper-dusted Wheat as a supplementary feed for Sheep.**—*Agric. Gaz. N.S.W.*, liv, 6, p. 288, 1943.

Trials were made in response to enquiries by farmers as to whether stocks of wheat already treated against bunt [*Tilletia caries* and *T. foetida*] could be safely used as feed for sheep. Wheat treated by mixing 2 oz. of a proprietary copper dust with 60 lb. grain was given to sheep as part of their feed at the rate of $\frac{1}{2}$ lb. per head daily for four months. No serious ill effects were produced, the treated grain being also as nutritious as untreated.

Further improvements of boom sprayers.—*Calif. Citrogr.*, xxviii, 10, pp. 265, 276, 1 fig., 1943.

A description is given of recent developments in the mechanical application of

citrus sprays with power outfits. The advantages of these boom sprayers are a saving in man power and increased speed. The amount of spray used on one machine was 10 per cent. more than with hand spraying. The machines can apply 1,200 gals. or more of spray per hour. They will not cover thickly foliated or very large trees, and cannot be used where there is not ample room to drive between the rows.

ROSE (D. H.), BROOKS (C.), BRATLEY (C. O.), & WINSTON (J. R.). **Market diseases of fruits and vegetables: Citrus and other subtropical fruits.**—*Misc. Publ. U.S. Dep. Agric.* 498, 57 pp., 20 pl. (16 col.), 1943. 70 cents.

This bulletin, the eighth in a series designed to facilitate the recognition and diagnosis of economically important diseases of citrus, avocado, banana, fig, mango, olive, papaw, pineapple, and pomegranate, comprises summaries of the information available to date on the symptomatology, etiology, and control of fungal pathogens, non-parasitic and physiological disorders, and injuries due to miscellaneous causes, illustrated by excellent photographic and coloured plates and supplemented by a bibliography of 146 titles.

ARENTSEN (S.). **Estudio de la susceptibilidad presentada por diversas especies y variedades de Citrus al ataque de Phytophthora citrophthora (Sm. & Sm.) Leon.** [A study of the susceptibility shown by different Citrus species and varieties to infection by *Phytophthora citrophthora* (Sm. & Sm.) Leon.]—*Bol. Sanid. veg., Santiago,* ii, 1, pp. 54–60, 3 figs., 1942.

In inoculation experiments carried out at the Biological Institute, São Paulo, Brazil, in 1941–2, to determine the relative susceptibility of 26 species or varieties of citrus to a bitter orange isolate of *Phytophthora citrophthora* from the Argentine, the most extensive trunk and branch lesions developed on the Villafranca lemon (average 183·3 sq. cm.). Other susceptible hosts included citrangequat [a cross between Willis citrange, *Poncirus trifoliata* × *Citrus sinensis*, and oval kumquat, *Fortunella margarita*], Satsuma orange (*C. nobilis* var. *unshiu*), and McCarthy and Duncan grapefruits (56·5, 56, 55, and 54·2 sq. cm., respectively). One strain of the sweet Persian lime was susceptible (59 sq. cm.) and another resistant (16). Resistance was further shown by two strains of Galician lime (9·5 and 18), Eureka lemon (19), Washington Navel orange (13·7), and Rio tangerine (14·7).

LEHMAN (S. G.). **Vapor action of certain fungicidal materials prepared for dusting Cotton seed.**—*Phytopathology,* xxxiii, 6, pp. 431–448, 1943.

In experimental disinfection of cotton seed with new improved ceresan the author found that at a rate of $\frac{1}{2}$ or $\frac{1}{4}$ oz. per bush. the improvement in seedling emergence was nearly as great as at higher rates. It was suggested that the effectiveness of the dust in so small quantities is due to the volatility of the mercurial ingredient. Experiments were therefore made to test the vapour action of mercurials on cotton seed, a weighed quantity of the test preparation being spread over the bottom of a desiccator or large culture dish, and the seed laid on wire racks above. The treated seeds were germinated in steamed sand or on paper towelling.

In one test, seed naturally infected with *Glomerella gossypii* and *Fusarium moniliforme* [*Gibberella fujikuroi*] was stored at laboratory temperature for three and sixteen days over new improved ceresan (ethyl mercury phosphate), while in another it was stored for two days over ceresan (ethyl mercury chloride), sufficient quantity of each dust being used to give equivalent weights of the active ingredients; another lot was dusted with ceresan. The controls gave only a low percentage of disease-free plants, while the seeds stored above ceresan and new improved ceresan, and those dusted with ceresan gave high percentages of healthy plants. Similar seed treated with the vapours from new improved ceresan at 14° C.

for 24 hours showed a higher percentage of germination and a much lower percentage of disease than the untreated controls. Exposure for 48 and 72 hours gave better control than exposure for 24 hours, but not such good control as did dusting. Exposure at 28° gave rather better control of seedling diseases than exposure at 14°. Vapour action by sanoseed (ethanol mercury chloride) was only weakly, if at all, effective at ordinary temperatures.

Vapour from ceresan, new improved ceresan, ethyl mercury borate, and ethyl mercury iodine was found to be lethal to conidia of *Glomerella gossypii* exposed on filter paper and on mycelium in Petri dishes. Because of the volatile nature of ethyl mercury chloride and ethyl mercury phosphate and their ability to condense on and adhere to cotton seed and seed-infecting fungi, very small ratios of quantity of chemical to quantity of seed are effective. The vapour action of ethyl mercury chloride and ethyl mercury phosphate is effective in the range of temperature (5° to 38°) likely to obtain between the treating and sowing of the seed.

In other tests the vapours of semesan (hydroxymercuro-chlorophenol), creosote dust, benzol, benzine (petroleum ether), para-dichlorobenzene, and picric acid exercised no inhibitory effect on air-dry conidia of *G. gossypii*. The germination of the conidia of this fungus was, however, reduced or prevented by the vapours of alkylmercuricacetyleneurea, leytosan (phenomercuricurea), 154–6B, chloropicrin, ethyl ether, and trioxymethane.

RAY (W.). **The rate of application of ceresan to Cotton seed.**—*Plant Dis. Reptr*, xxvi, 22, pp. 474–476, 1942. [Mimeographed.]

When seed of Stoneville 2B cotton (1) fuzzy, (2) re-ginned, and (3) acid-delinted was treated with new improved ceresan at the rates of ½, 1, and 1½ oz. per bush. and planted, the treatment, regardless of the rate of application and the kind of seed, gave stands statistically superior to those of the controls. No significant differences were found for the amount of ceresan applied when expressed in percentage of final stand. The acid-delinted (gravity-graded) seed was superior in point of stand to the other kinds. These results show that the amount of ceresan applied to fuzzy, re-ginned, and acid-delinted cotton seed can safely be reduced to less than 1½ oz. per bush.

SMITH (H. P.) & BYROM (M. H.). **Effects of planter attachments and seed treatment on stands of Cotton.**—*Bull. Tex. agric. Exp. Sta.* 621, 16 pp., 7 figs., 1942.

Undelinted cotton seed treated with ceresan, lime, and sulphur at Texas Agricultural College Station gave, respectively, 71, 55, and 59·6 per cent. average emergence, as against 59·8 per cent. for the control, the corresponding figures for Nacogdoches Substation being 83, 54, 58, and 59 per cent. The figures for delinted seed similarly treated were 85·4, 73·6, 79·3, and 80·5 per cent. in the former place and 89·4, 72·5, 82·8, and 80 per cent. for the latter. Thus, with both undelinted and delinted seed, ceresan treatment substantially increased stands as compared with lime or sulphur or no treatment. Lime appeared to reduce germination, while sulphur had little, if any, effect.

ARNDT (C. H.). **Pythium ultimum and the damping-off of Cotton seedlings.**—*Phytopathology*, xxxiii, 7, pp. 607–611, 1943.

Pythium ultimum has been found to be a common agent of cotton seedling damping-off in sandy loam soil in South Carolina when planting is followed by cool, wet weather. In experiments in which Cleveland Big Boll seedlings from acid-delinted, sterilized seed were grown in soil inoculated with a raisin-oatmeal agar culture of the fungus at temperatures of 18°, 21°, 24°, 27°, and 30° C., and a moisture content of 60 per cent., only slight infection occurred at 30°, but severe at lower temperatures, all the plants being killed at 21° and 18°. The results

secured when the seedlings were grown for six or twelve days at 30° in infested soil and then transferred to 22° indicate that *P. ultimum* will cause heavy losses through damping-off only if conditions favouring infection develop before the host reaches a stage of maturity comparable to that attained in a growth period of six days at 30°.

MILLER (P. R.) & WEINDLING (R.). **Cotton seedling diseases and boll rots. Distribution and dissemination.**—*Plant Dis. Reptr, Suppl.* 141, pp. 53–78. 2 maps, 1943. [Mimeographed.]

A summary is given of surveys of cotton diseases conducted from 1938 to 1941 in 14 American states [*R.A.M.*, xxi, p. 196]. *Glomerella gossypii* was recovered from 81·2 per cent. of the diseased seedling samples and from 67·8 per cent. of the bolls. It was widely distributed throughout the south-eastern states, but in Texas and Oklahoma its occurrence is limited to the eastern portions. The failure to find this fungus in the western Belt is attributed to unfavourable, dry conditions preventing its survival during the period between the damping-off and the boll rot stages.

Experiments conducted during the surveys showed that a simple relationship between climate and relative abundance of *G. gossypii* could not be established, the data indicating that in addition to rainfall other factors are important, such as availability of dead plant tissue and of shade provided by close stands. The fungus was found to survive the summer in Texas on the stems, leaves, and bracts of cotton plants; it is suggested that it did so in a quiescent form and that the unusually wet weather in the spring of 1941 provided better conditions for its persistence than in ordinary years. Latent infections of stems, leaves, and other organs of the cotton plant often occur in the eastern parts of the cotton belt, to be followed, when moisture conditions become favourable, by saprophytic development in rotting tissues, thus providing potential sources of inoculum for boll infection and seed infestation.

In another set of experiments in South Carolina, contamination was carried over from infected trash to seed cotton, in proportion to the spore load of the trash, and from severely contaminated seed samples to those ginned subsequently. It is concluded that contamination of seed in the gin accounts for much of the *Glomerella* damping-off of seedlings in the eastern part of the cotton belt, and that infected trash plays an important role in this process.

In ginning tests with seed samples from South Carolina and Georgia (all containing *G. gossypii*) and from Oklahoma and Texas (all free from infection), it was found that after ginning the infected cotton, spores left on the ginning equipment caused sufficient contamination of the disease-free samples ginned subsequently to be detected by the spore load determination method. The number, per seed, of spores of *Fusarium*, *Diplodia*, and *Alternaria* spp. was generally lower after ginning than before.

When *G. gossypii*-contaminated seed was planted in 20 different localities, spore load determinations, made on seed after ginning, showed that relatively high spore loads were present on seed from localities in the more humid belt, e.g., coastal areas, and low loads on those from the inland sections of the eastern cotton belt where lower humidity prevails; no spores were found on seed from the sub-humid and semi-arid belt of Texas and Oklahoma.

GOODAVAGE (J. E.). **Mildewed Cotton fabrics.**—*Amer. Dyest. Reptr*, xxxii, 12, pp. P265–P270, 1943.

A semi-popular account is given of the structure and life-history of some of the principal agents of mildew in cotton fabrics [*R.A.M.*, xxii, p. 396], with special reference to the conditions prevailing in the tropics, where damage to military clothing and equipment from this source is stated to constitute a major problem

for the Philadelphia Quartermaster Depot. The author then enumerates the fungicides fulfilling the necessary requirements and describes three methods of applying them, i.e., by an organic solvent, precipitation, and a single bath, and briefly discusses their relative merits. The outstanding fungicidal properties of copper naphthenate are to some extent vitiated by its penetrating odour and production of colour on the treated fabric, the objectionable smell being also characteristic of the slightly less effective zinc naphthenate. Pentachlorophenol, which inhibits the growth both of cellulose-destroying (*Chaetomium globosum* and *Metarrhizium* [? *anisopliae*]) and superficial moulds, e.g., *Aspergillus* and *Penicillium* spp., including *P. glaucum*, and is particularly effective when applied by the two-bath method, is an irritant and therefore of limited utility in the protection of clothing materials. Another phenolic derivative, dihydroxy-dichlor-diphenylmethane, however, combines toxicity to all types of moulds with absence of irritant properties. The cheap and efficient ortho-phenylphenol has the drawback of poor water repellancy, involving rapid removal by leaching. The cuprammonium products are open to various objections precluding their large-scale use. The most remarkable of the mercury compounds used against textile mildews is phenyl mercury trinitriloethanol lactate, while promise has also been shown by the newly developed quaternary amines, alkyl dimethylbenzyl ammonium salts and cetyl pyridinium chloride, and the wholly organic amino-guaiacol benzothiazole imino-urea. The 'modifying' leaching or spray and the accelerated mildew performance tests used at the Depot are briefly described.

SCHAERFFENBERG (B.). **Die biologische Bekämpfung des Maikäfers und seiner Larve mit Beauveria densa.** [The biological control of the Cockchafer and its larva with *Beauveria densa*.]—*Anz. Schädlingsk.*, xvii, pp. 53–55, 1941. [Abs. in *Z. PflKrankh.*, lii, 12, p. 563, 1942.]

Previous failures in the experimental control of the cockchafer [*Melolontha melolontha*] by means of *Beauveria densa* are attributed to differences between the insect and fungus requirements in respect of soil conditions. Theoretically, the inhibitory functions of the fungus should operate most successfully in damp forest soils well supplied with humus, whereas mass multiplication of the cockchafer is effected chiefly in dry, sandy situations. Laboratory tests confirmed this hypothesis to the extent of showing that infection by *B. densa* takes place more readily under the former than under the latter conditions.

CHADA (H. L.), DITMAN (J. A.), & DAIGH (F. C.). **Progress during 1942 of the program for the colonization of the milky disease of Japanese Beetle larvae in Delaware.**—*Trans. Peninsula hort. Soc.*, xxxii, 5, pp. 86–92, 1 fig., 1943.

This is the progress report for 1942 on the experimental establishment of type A milky disease (*Bacillus popilliae*) of Japanese beetle (*Popillia japonica*) larvae [*R.A.M.*, xxii, p. 137] in Delaware.

During the autumn and winter of 1941–2, some 213,000 fully-grown larvae were dug from sod in a heavily infested area and stored in cans of soil. Inoculation and incubation were effected at the Delaware Agricultural Experiment Station. Type B milky disease (*B. lentimorbus*) was found to have infected some of the larvae, but it was considered unsuitable for this work.

Of 129,624 larvae inoculated, only 0·5 per cent. failed to develop the disease and from 70,878 diseased larvae 2,208 lb. of finished spore dust were produced.

The results of the survey, while not entirely conclusive, indicate that the milky disease is becoming established on the colonization plots, as is shown by the numbers of diseased larvae. The reduction in numbers of larvae and the corresponding reduction in adult beetle populations observed during the summer cannot,

however, be attributed solely to the establishment of the disease. Other factors, such as adverse climatic conditions, have not been without effect.

FORSYTH (D. D.) & SCHUSTER (M. L.). **Abnormal leaf formation on Flax seedlings caused by spergon.**—*J. Amer. Soc. Agron.*, xxxv, 8, pp. 733–735, 2 figs., 1943.

Some 80 per cent. of Bison and Redwing flax seedlings arising from seed treated with spergon (2 oz. per bush.) prior to sowing on 6th April, 1942, at the Washington Agricultural Experiment Station, were observed on 10th May to show a foliar abnormality consisting in the apparent lateral fusion of two to six leaves at the same node, the corresponding incidence for the sowings of 18th and 20th April being 30 per cent. The distortion usually involved the fifth to the tenth leaf above the cotyledons. In greenhouse tests carried out in 1943 evidence was obtained that the abnormality was due to treatment with spergon, the prevalence increasing with the dosage. The experiments were made with machine-threshed seed, the seed coats of 65 to 75 per cent. of which were found on microscopic examination to bear minute cracks or open breaks, providing a channel of entry to the epicotyl for the disinfectant.

LYLE (E. W.). **Black-spot on Rose canes.**—*Amer. Rose Annu., 1943*, pp. 155–156, 1 fig., 1943.

Attention is drawn to the occurrence of black spot [*Diplocarpon rosae*: *R.A.M.*, xxii, p. 24] on rose canes, where the minute lesions are readily overlooked in contrast to the more conspicuous effects on the foliage. Spores from cane spots have been known to germinate to the extent of 76 per cent., and may therefore constitute a source of inoculum for the propagation of the fungus in gardens from which all fallen leaves have been removed during the dormant period. Both leaf and cane lesions have been observed on Susan Louise, previously reported to be immune (*Plant Dis. Reptr*, xxiv, pp. 478–480, 1940), and in a greenhouse inoculation test on the same variety infection also developed on the canes and leaves, nearly all the latter being lost. This variety is, however, probably more resistant to black spot than many others, though the Welch Multiflora understock represents one of the few cases of true immunity. The application of fungicides against black spot should be continued well into the autumn. In the commercial rose fields of eastern Texas very satisfactory control of *D. rosae* has been secured with a mixture of 90 per cent. 325-mesh dusting sulphur and 10 per cent. Tennessee Copper 34, other preparations suitable for combination with the former at 5 to 15 per cent. including cuprocide GA, cupro K, copper oxychloride sulphate, spray cop, zinc coposil, copper hydro 40, and Dow Bordow.

WEISS (F.). **Notes on some diseases of ornamentals.**—*Plant Dis. Reptr*, xxvi, 15, pp. 331–333, 1942. [Mimeographed.]

Colletotrichum trichellum [*R.A.M.*, xiii, p. 309] was found causing a serious stem disease as well as a leaf spot of ivy, *Hedera helix*, for which the name anthracnose is considered appropriate. The examined specimens were collected in a ground bed in 1942.

The alpha conidial stage of *Phomopsis lirella* (but not the beta) was isolated in 1942 from the stem bases and, after incubation, from stem cankers of *Vinca minor* (received among other localities from Washington, Virginia, and Maryland), indicating that the fungus is definitely parasitic on this host.

Phytophthora cactorum [ibid., xii, p. 696] is reported to have caused a severe top blight and in some cases the death of hybrid rhododendrons in Washington. This is the most southerly record of this disease in the United States.

LIHNELL (D.). **Undersökningar över 'blad-och-grentorka' hos importerade Azaleor.** [Investigations on 'leaf and twig blight' in imported Azaleas.]—*Medd. Växtskyddsanst., Stockh.*, 40, 74 pp., 14 figs., 2 diags., 1 graph, 1943. [English summary.]

This is a comprehensive, tabulated account of investigations on an economically important leaf and twig blight of azaleas (*Rhododendron* spp.) imported into Sweden, mostly from Belgium [cf. *R.A.M.*, vi, p. 615, vii, p. 640], for forcing during the winter, among the varieties chiefly affected being Mme Petrick, Paul Schäme, Theo Findeisen, and Mme Aug. van Damme. The most conspicuous symptom of the disease is copious defoliation of the acropetal type characteristic of normal leaf fall, the subsequent twig blight, however, beginning at the apex and progressing downwards towards the main branch. Blackish-brown blotches soon develop on the dead and dying leaves as a result of infection by *Pestalotia* spp. [ibid., xiv, p. 173], including *P. rhododendri* (group), *P. macrotricha* [ibid., xiii, p. 598], *P. guepini* [ibid., xi, p. 650], *P. vermiformis* [ibid., xiii, p. 598], and an as yet unidentified, possibly new species, *P.* 53, characterized by conidia measuring 19 by 8μ, the two dark brown middle cells 13μ in length, and setae 13 to 25μ long. The pathogenicity of these organisms, however, could not be established by inoculation tests. The cause of the trouble was accordingly sought in adverse environmental factors, decisive among which was experimentally shown to be the carbon dioxide poisoning sustained during transport in inadequately ventilated crates.

LIHNELL (D.). **Hur se edra Dahlior ut?** [How do your Dahlias look?]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 4, pp. 3–5, 3 figs., 1943.

This is a popular note on the mosaic disease of *Dahlia variabilis*, which is stated to be so widespread in Sweden that an extensive planting without stunted and mottled individuals is a rarity. Recently imported consignments, alleged to be from Denmark, were found, moreover, to show 100 per cent. infection. Growers are urged to eradicate any suspected plantings and to use only healthy material for propagation, the new beds to be located as far as possible from those already in existence.

KREITLOW (K. W.). **Sclerotium rhizodes on grasses in Pennsylvania.**—*Plant Dis. Reptr*, xxvi, 16, pp. 360–361, 1942. [Mimeographed.]

Sclerotium rhizodes was recently observed on leaves of *Poa pratensis* and *Agrostis alba* in Pennsylvania, this apparently constituting the first record of the disease in the State.

HERBERT (D. A.). **Diseases of native plants in Queensland.**—*J. Aust. Inst. agric. Sci.*, ix, 2, pp. 63–68, 1943.

In this paper, given as the presidential address to the Queensland Branch of the Australian Institute of Agricultural Science on 12th March, 1943, the author discusses, *inter alia*, the ergot situation in Australia, where records of *Claviceps purpurea* on grasses have not been substantiated by R. F. Langdon (*Proc. roy. Soc. Qd*, liv, pp. 23–32, 1942), the ergot on *Bothriochoa intermedia*, for instance, being *C. pusilla* [*R.A.M.*, xxi, p. 81], which probably also occurs in India and Ceylon. The first official record of paspalum ergot [*C. paspali*] was that of the epidemic on *Paspalum dilatatum* in 1935–6 [ibid., xv, p. 724], but *P. orbiculare*, a native grass, was observed to be affected in 1934. Among important native plant diseases mention is made of *Uromycladium tepperianum*, which may destroy commercial plantations of *Acacia pycantha*. Other points dealt with include the problem of deciding whether a parasite is introduced or native, variations within fungal species, and geographical considerations affecting plant diseases.

Young (P. A.). **A canker disease of Crotalaria spectabilis in Texas.**—*Plant Dis. Reptr*, xxvi, 20, p. 438, 1942. [Mimeographed.]

During dry summer weather in 1941 and 1942, numerous *Crotalaria spectabilis* plants at the Tomato Disease Laboratory, Jacksonville, Texas, appear to succumb to a canker disease of the stem and upper part of the tap-root. A white mould was occasionally observed on the cankers near the crown. Cultures from affected material almost invariably yielded *Sclerotium* (*Rhizoctonia*) *bataticola* [*Macrophomina phaseoli*]. Further investigations are to be made.

Weimer (J. L.). **The thinning of Crotalaria stands in Southeastern United States.**—*Plant Dis. Reptr*, xxvii, 3–4, pp. 110–111, 1943. [Mimeographed.]

Gradual thinning of *Crotalaria* stands in south-eastern regions of the United States, where several species of the genus are used as summer cover crops, was found to be due to a wilt associated with a number of fungi, of which the following were proved to be pathogenic to *C. intermedia*: *Rhizoctonia* [*Corticium*] *solani*, *R.* sp., *Macrophomina phaseoli* [see preceding abstract], *Sclerotium rolfsii*, and a strain of *Fusarium oxysporum*. Other fungi isolated, but not found pathogenic under the experimental conditions, were *Phoma* sp., *F. solani*, and an organism that forms pycnidia resembling those of *Diaporthe crotalariae*. *C. solani* was isolated most consistently from the younger plants, but was not found at all in some lots. Normally the *Crotalaria* stands are maintained by 'volunteers' for a number of years and the thinning makes it necessary to re-sow more frequently.

Chilton (S. J. P.), Henson (L.), & Johnson (H. W.). **Fungi reported on species of Medicago, Melilotus, and Trifolium.**—*Misc. Publ. U.S. Dep. Agric.* 499, 152 pp., 1943. 20 cents.

The increasing use of *Medicago*, *Melilotus*, and *Trifolium* spp. as war-time substitutes for nitrogenous fertilizers has prompted the publication of this bulletin, which comprises lists of the fungal pathogens of the three crops, arranged both under hosts and fungi, as well as 1,733 bibliographical references to the relevant literature.

Fischer (G. W.), Sprague (R.), Johnson (H. W.), & Hardison (J. R.). **Host and pathogen indices to the diseases observed on grasses in certain western States during 1941.**—*Plant Dis. Reptr, Suppl.* 137, pp. 87–144, 1942. [Mimeographed.]

This is a summary of the data obtained from collections and observations of grass diseases made during 1941 in the States of Arizona, California, Idaho, Minnesota, Nebraska, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming [cf. *R.A.M.*, xxi, p. 493]. The total number of diseases enumerated on 259 grass species and varieties is 161, including *Puccinia graminis*, *Fusarium scirpi* var. *acuminatum* [ibid., xx, p. 353], *P. rubigo-vera*, *P. glumarum*, *Scolecotrichum graminis*, *Helminthosporium sativum*, *Claviceps purpurea*, *Sclerophoma donacis* and its varieties, and *Pythium arrhenomanes* on 81, 63, 54, 53, 53, 53, 50, 43, and 42 hosts, respectively.

Chester (K. S.) & Lefebvre (C. L.). **Ergot epiphytotic in southwestern pastures.**—*Plant Dis. Reptr*, xxvi, 19, pp. 408–410, 1942. [Mimeographed.]

In the winter of 1941–2 many cases of cattle abortion were reported in the vicinity of the Texas Panhandle, and it was ascertained that the affected animals have fed on big bluestem (*Andropogon furcatus*), sand bluestem (*A. hallii*), and Indian grass (*Sorghastrum nutans*), all of which bore considerable quantities of ergot, tentatively identified as *Claviceps purpurea*. During 1941 ergot was exceptionally prevalent in the adjacent States, and in the spring of 1942 an examination

of the pastures in Hemphill County, in the Texas Panhandle, showed abundant ergot present in wild rye grasses (*Elymus canadensis* and *E. virginicus*). Infestation ranged from 5 per cent. or more in western wheat grass (*Agropyron Smithii*) to an estimated 100 per cent. in Canada wild rye. The soil under the wild rye was littered with sclerotia, and individual heads showed 1 to 27 sclerotia each. A 10-bush, sample of western wheat grass seed from Booker, Texas, contained 41 per cent. ergot by weight. The paper concludes with practical suggestions for ergot control in the conditions prevailing in the Southern Great Plains.

Mühle (E.). **Die Rostpilze der wichtigsten zur Samengewinnung angebauten Futtergräser.** [The rust fungi of the most important fodder grasses cultivated for seed production.]—*Phytopath. Z.*, xiv, 1, pp. 83–101, 1942.

This is a critical, tabulated survey of the literature on grass rusts, of which the following have been observed by the writer or reported by the Biological Institute during the last 20 years in Germany: *Puccinia graminis* on *Agrostis alba*, *Alopecurus pratensis*, *Arrhenatherum avenaceum*, *Avena flavescens*, *Bromus inermis*, *Dactylis glomerata*, *Festuca ovina*, *Lolium perenne*, and *Phalaris arundinacea*, *Puccinia coronata* on *Agrostis alba*, *Alopecurus pratensis*, *Arrhenatherum avenaceum*, *D. glomerata*, *F. pratensis*, *L. italicum*, and *L. perenne*, *P. bromivora* on *B. inermis*, *P. festucae* on *F. ovina* and *F. rubra*, *P. persistens* on *Poa pratensis*, *Puccinia phalaridis* on *Phalaris arundinacea*, *Puccinia phlei-pratensis* on *Phleum pratense*, *Puccinia poarum* on *Poa fertilis* and *P. pratensis*, and *Puccinia triseti* on *Avena flavescens*. Of recent years the heaviest damage has been sustained by stands of *Alopecurus pratensis*, *F. pratensis*, *L. perenne*, *Phleum pratense*, and *Poa pratensis*. The development of rust-resistant types of grass is the most promising control measure and the problems confronting the plant-breeder in this connexion are discussed. A bibliography of 83 titles is appended.

Stephens (C. G.) & Oertel (A. C.). **Responses of plants to molybdenum in pot experiments on the Cressy shaley clay-loam.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 2, pp. 69–73, 2 graphs, 1943.

In pot experiments with subterranean clover on Cressy shaley clay-loam, an Australian soil capable of reverting superphosphate, the addition of very small additions of molybdenum salts induced an intensely dark green colour of the plants contrasting with the pale green of the untreated controls. The yields of the treated plants were increased from an average of 7·4 to 8·75 gm. per pot and the molybdenum content of the harvested material from 0·5 to 2 p.p.m. In further experiments with perennial rye grass [*Lolium perenne*] and white clover no colour change in the former was noted but in the latter the untreated showed increasing intensity of greenness with increased liming and the treated were uniformly dark green; the yields and molybdenum contents were increased in both plants by the addition of molybdenum salts, the evidence indicating that availability of molybdenum increases in passing from acid to alkaline soils. Spectrochemical analysis showed a minimum requirement of 1 p.p.m. dry material for normal growth.

Kreitlow (K. W.). **Investigations on seed treatment of forage grasses and legumes for control of damping-off.**—*Plant Dis. Reptr*, xxvii, 3–4, pp. 111–112, 1943. [Mimeographed.]

In preliminary tests carried out in the field on seven different dates in the spring and autumn of 1942, Sudan grass [*Sorghum sudanense*] seed treated against pre-emergence damping-off averaged 12 per cent. increase in stand over untreated seed, the figure in one case reaching 24 per cent. The best results were given by spergon and semesan dusts, while Du Bay 1205 FF and yellow cuprocide were slightly less beneficial. In greenhouse tests with Sudan grass and known patho-

genic cultures of *Pythium*, the stand was more than doubled as a result of using treated seed.

In field tests with lucerne, stands were increased by 5 to 17 per cent. when the seeds were dusted with yellow cuprocide, the average increase for five tests being 8 per cent. Treatment with spergon and Du Bay gave similar results. Treatment of red clover [*Trifolium pratense*] seed with Du Bay 1205 FF gave an average increase in stand of 9 per cent., the greatest increase for any one planting being 12 per cent.

WELLHAUSEN (E. J.), KREITLOW (K. W.), & LEACH (J. G.). **Observations of the prevalence and economic importance of stripe smut (Ustilago striaeformis) on Bluegrass.**—*Plant Dis. Reptr*, xxvii, 1, pp. 23–24, 1943. [Mimeographed.]

Of a total of 504 plugs of sod taken at random from typical bluegrass (*Poa pratensis*) pastures in West Virginia and planted at Morgantown for observation, smut (*Ustilago striaeformis*) [*R.A.M.*, xix, p. 351] developed in plants from 15 per cent. of the plugs. A survey then revealed that the disease is widely prevalent both in West Virginia and Pennsylvania. No pasture was found to be completely unaffected, and in some, over 25 per cent. of the plants were attacked. It is considered that in any programme of bluegrass improvement, smut resistance will have to be taken into consideration.

AITKEN (Y.) & GRIEVE (B. J.). **A mosaic virus of Subterranean Clover.**—*J. Aust. Inst. agric. Sci.*, ix, 2, pp. 81–82, 1943.

For some years past, mosaic symptoms and marked stunting have been present on *Trifolium subterraneum* at Burnley Gardens, Victoria, and in 1941 and 1942 it became apparent that the disease was widespread in the State. Rapid spread has occurred in the affected areas, resulting in a 50 per cent. reduction in spring growth. On *T. subterraneum* the first symptom is clearing of the main veins of young leaves. Lamina mottling follows, becoming progressively more intense. The leaves are distorted, assuming a narrow wedge shape with a wavy margin. The infected plants are dwarfed. Seed production may be greatly reduced, and there was some evidence of seed transmission.

Experimental evidence demonstrated that the disease was transmitted by expressed juice, using the spatula and carborundum method. Dilutions up to 1 in 1,000 were effective. Transmission of the virus to *T. incarnatum* and then to *Phaseolus vulgaris* resulted in a higher percentage of infection with more severe symptoms than was the case when the inoculation was made to French bean directly. Aphids were ascertained to transmit the virus. Heating at 60° C. for 10 minutes resulted in complete inactivation. After 24 hours the percentage of successful transfers was one-third of that recorded immediately on extraction of the juice; after 48 hours no transfer could be obtained.

The virus differs from common pea mosaic in infecting *P. vulgaris*, soy-bean, and sweet clover (*Melilotus alba*); from common bean mosaic in infecting French bean var. No. 5 Refugee, blue lupin (*Lupinus angustifolius*), *M. alba*, soy-bean, *Trifolium hybridum, T. incarnatum, T. pratense*, and peas, and in producing much more severe symptoms on French bean; from yellow bean mosaic (white sweet clover mosaic) in infecting *T. hybridum, T. pratense, P. lunatus* (Henderson's Lima bean); and from alsike clover virus 2, in infecting *T. pratense* and soy-bean.

All the described varieties of subterranean clover grown in Australia are susceptible; eradication of perennial legumes, in which the virus may pass the summer, from the vicinity of clover is suggested as a possible means of control.

TURNBULL (J.). **Orchard spraying for commercial growers.**—*'Growmore' Bull. Minist. Agric., Lond.*, 9, 14 pp., 5 figs., 1 diag., 1943.

Up-to-date information on the care and maintenance of spraying equipment and the management and methods of orchard treatment is presented with special emphasis on the modifications in ordinary routine practice necessitated by war-time conditions.

HAMILTON (J. M.) & WEAVER (L. O.). **Freezing preservation of fungi and fungus spores.**—*Phytopathology*, xxxiii, 7, pp. 612–613, 1 fig., 1943.

A new technique, involving quick-freezing and storage of the galls of *Gymnosporangium juniperi-virginianae* and the conidia of *Venturia inaequalis*, has been found at the New York (Geneva) Agricultural Experiment Station to provide a readily available source of inoculum throughout the year. Cedar galls, $\frac{3}{4}$ in. and upwards in diameter, with teleuto horns $\frac{1}{2}$ in. long when dry, are placed in paraffined Dixie cups, standing in vapour-proof metal containers, and held at a temperature of $-10°$ C. Twelve hours after transference to room temperature, the galls are placed in a misty spray in preparation for spore discharge. Sporidia obtained from the frozen galls were found to be equally viable with those from field material. The teleutospores on galls kept at $-10°$ for nine months functioned normally, and three spore discharges were obtained from a single gall refrozen after each discharge. Viable sporidia have been obtained 15 months after the first freezing of the cedar-apple rust galls. Sporidia in water suspension have been stored at $-10°$ and $-40°$, but after three weeks an appreciable decline in viability supervenes.

In the case of *V. inaequalis* conidia it is necessary to line the cups with a layer of ice before the suspension is poured into them to prevent settling at the bottom, the inoculum being obtained by chipping a piece of ice from the block, defrosting, and diluting to an appropriate strength. Conidia frozen for over 15 months germinate excellently, but are more readily inhibited by fungicides than fresh ones. No damage to the spores resulted from freezing at $-40°$. The new procedure has worked equally well with *Sclerotinia fructicola* and F. Suit has successfully frozen the conidia of *Plasmopara viticola*.

HAMILTON (J. M.), PALMITER (D. H.), & MACK (G. L.). **Particle size of sulphur and copper fungicides in relation to Apple scab and Cedar-Apple rust control.**—*Phytopathology*, xxxiii, 7, pp. 533–550, 3 figs., 1 graph, 1943.

The results of laboratory, greenhouse, and field tests carried out at the New York State Agricultural Experiment Station indicated that the fungicidal efficacy of ground wettable sulphurs and an insoluble copper fungicide is inversely proportional to particle size [*R.A.M.*, xxii, p. 260]. A wettable sulphur and the insoluble copper, ground to three degrees of fineness to include the range of particle sizes found in most commercial brands, were used in the tests, the sulphurs being tested in the field against apple scab (*Venturia inaequalis*), both sulphurs and copper in the greenhouse against rust (*Gymnosporangium juniperi-virginianae*), and on potted apples and in spore germination studies on brown rot (*Sclerotinia fructicola*). In trials with commercial wettable sulphur preparations, the toxicity was influenced not only by particle dimensions, but also by the presence of various adjuvants and by different methods of manufacture. Sulphur materials prepared by the Grinrod and flotation processes were relatively less adhesive than ground sulphur of equal particle size in the absence of an adjuvant.

The Andreasen sedimentation and air-permeation procedures for the computation of particle-size measurements [loc. cit.] were found to be the most reliable of the four methods tested for this purpose. The results of these determinations received further confirmation from photomicrographs of the particles, which

clearly demonstrate the presence of many more particles per unit area, for a given weight of material, in fine than in coarse dusts.

HOPPERSTEAD (S. L.), GOODWIN (M. W.), & KADOW (K. J.). **Bitter rot of Apples and its control in Delaware.**—*Bull. Del. agric. Exp. Sta.* 241, 23 pp., 2 graphs, 1943.

Bitter rot (*Glomerella cingulata*) is a serious problem in Delaware on certain susceptible apple varieties, such as Lily of Kent, Northwestern and Rhode Island Greenings, and Stark. The symptoms of the disease and the life-history of the pathogen are described in semi-popular terms. The results of control experiments covering the period from 1938 to 1940 yielded the following information. The removal of diseased and mummified fruits was inadequate as a means of eliminating infection and is not recommended. Spraying with Bordeaux mixture 4–4–100 should be started at the fourth or fifth cover and repeated at least once a fortnight; alternatively, the first two applications may be made with high concentrations and later ones with lower dosages. The copper load necessary to confer sufficient protection is about 200 microgm. per sq. in. of leaf surface, maintained throughout the season of activity of the fungus. Insoluble copper materials proved inferior to Bordeaux mixture in the control of *G. cingulata*, mostly by reason of their poor adhesive qualities, which were not improved by the admixture of spreader-stickers.

BJÖRLING (K.). **En kräftliknande sjukdom på Äppelträd, förorsakad av Myxosporium mali (Bres.).** [A canker-like disease of Apple trees caused by *Myxosporium mali* (Bres.).]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 3, pp. 4–8, 5 figs., 1943.

Myxosporium mali [*R.A.M.*, vii, 699] was isolated in May, 1942, from sunken, yellowish-brown cankers on the branches of three-year-old apple trees from a nursery at Alnarp, Sweden, in one section of which 60 out of 252 were attacked, four being so extensively girdled that the branches above the site of invasion were killed. The discoloration was found to penetrate the bark to a depth of 1 to 2 mm., while alternating brown and black zones, 2 mm. in breadth, occupied the transitional area between the healthy and diseased portions of the branch. The elongated-oval, hyaline conidia of *M. mali* are considerably smaller than those of the related species, *M. corticola* [ibid., xv, pp. 260, 468], measuring 7 to 8 by 3μ. The results of some 30 inoculation tests on six trees showed the pathogen to be strictly dependent on a previous lowering of resistance in the host due to injury, e.g., by frost. The spread of the fungus in the diseased branches of the nursery trees was retarded, but not completely arrested, by scarification of the infected areas and bandaging the wounds with paper.

In the following April about 30 trees, including 15 Bramleys and 12 Ontarios, in the same nursery were also attacked by *M. mali*, and an examination of the root systems of three of the most severely damaged revealed coincident heavy infection by the crown gall organism (*Pseudomonas* [*Bacterium*] *tumefaciens*). The nurseryman stated that most of the East Malling II and IV stocks, used for grafting the Bramleys and Ontarios, respectively, were already affected by the bacterial disease at the time of planting. In this case, therefore, the impairment of vitality by *Bact. tumefaciens*, rather than any inherent varietal susceptibility, appears to have predisposed the trees to infection by *M. mali*.

HILDEBRAND (E. M.). **A latent virosis on Lombard Plum in New York.**—*Plant Dis. Reptr*, xxvi, 21, pp. 454–455, 1942. [Mimeographed.]

Five years after the removal of all trees affected with prune dwarf virus [*R.A.M.*, xxii, p. 31] from an Italian prune orchard containing two Lombard plum trees in

Niagara County, New York, the disease reappeared, on this occasion attacking also one of the Lombard trees. Following grafts from the other, presumably healthy, Lombard tree, severe necrotic spotting developed on the foliage of Italian prune and a milder condition on Bradshaw plum. A latent virosis on Lombard plum was also reported from Canada recently by Willison on p. 73 of the handbook on stone fruit virus diseases published by Hildebrand *et al.* [ibid., xxii, p. 142].

Tindale (G. B.) & Huelin (F. E.). **Bitter pit in Granny Smith Apples.**—*J. Dep. Agric. Vict.*, xli, 5, pp. 246–250, 2 figs., 1943.

Four years' studies in Victoria on the development of bitter pit [*R.A.M.*, xxii, p. 212] in Granny Smith apples during storage consistently demonstrated that the condition can be reduced to a minimum by late picking (about the end of April under local conditions) combined with immediate cool storage. In all four years immediate storage greatly reduced the disease, as compared with delayed storage. Control was usually much greater in the case of the final picking (about the end of April) than in the two earlier ones tested (about the end of March to middle of April). Maximum liability to pit was reached with quite short delays before storage. Further delay had no consistent effect in this respect, but prolonged delay certainly reduced storage life. This practice, commonly adopted in Victoria to reduce superficial scald in Granny Smith apples, should be abandoned. The evidence of one test indicated that coating the fruit by dipping it in an alcoholic solution containing 10 per cent. castor oil and 5 per cent. shellac may greatly reduce pit development [see above, p. 468]. Growing conditions appear to be as important a factor as maturity or delayed storage, and experiments on water supply control should be made.

Dunegan (J. C.). **Iron dimethyl dithiocarbamate—a possible substitute for Bordeaux mixture for the control of Apple blotch.**—*Plant Dis. Reptr*, xxvii, 3–4, p. 101, 1943. [Mimeographed.]

When Ben Davis apple trees in Arkansas were sprayed with ferric dimethyl dithiocarbamate [*R.A.M.*, xxi, p. 506] at the rate of 1½ lb. per 50 gals. for six consecutive applications, under 0·1 per cent. of the fruits developed blotch [*Phyllosticta solitaria*: ibid., xxi, p. 441] lesions, as compared with 40·8 per cent. for the unsprayed controls; 0·3 per cent. of the fruits on trees sprayed with Bordeaux mixture (2–4–50) were affected.

Blodgett (E. C.). **Rasp leaf of Cherry.**—*Phytopathology*, xxxiii, 7, pp. 620–622, 1 fig., 1943.

The following conclusions have been reached on the basis of the writer's studies on cherry rasp leaf [*R.A.M.*, xxi, p 378] in Idaho. The virus is readily transmissible by bud inoculation, its incubation period being only nine months, judging by the typical symptoms developing in May, 1942, in Mazzard seedlings and young Bing and Montmorency trees grafted in the previous August. There is reason to believe that the rasp leaf virus is unevenly distributed and moves rather slowly in the affected trees. The symptoms of the disease may appear on the leaves of terminal shoots of bud-inoculated mazzard seedlings. At the moment, rasp leaf is of no commercial importance in Idaho and has not been observed to spread naturally, but it exerts a potentially serious devitalizing influence on its host.

Jeffers (W. F.). **Further progress in breeding Strawberries for resistance to red stele.**—*Trans. Peninsula hort. Soc.*, xxxii, 5, pp. 70–71, 1943.

When the 95 strawberry varieties previously selected for resistance to *Phytophthora fragariae* [*R.A.M.*, xxi, p. 421; xxii, p. 463] were experimentally inoculated by pouring zoospores on the roots, 57 of the selections developed infection. One

outstandingly resistant hybrid has been produced. It is a cross of Aberdeen by Fairfax, and fulfils all the requirements for a good commercial variety. This selection is early mid-season, very productive, forms firm, attractive, high-quality fruits, and makes clean vigorous plants.

Blueberry diseases in Maine.—*Bull. Me agric. Exp. Sta.* 419, pp. 395–417, 16 figs., 1943.

Much of the information given in this account of the present position regarding blueberry (*Vaccinium* spp.) diseases in Maine is based on the studies of Florence L. Markin, which were noticed at the time of publication from another source [*R.A.M.*, x, p. 532]. Generally speaking, the most important diseases at the moment are witches' broom (*Calyptospora columnaris*), leaf rust (*Pucciniastrum myrtilli*), and powdery mildew (*Microsphaera alni* var. *vaccinii*), less damage being caused by red leaf (*Exobasidium vaccinii*), shoot blight and fruit rot (*Sclerotinia* sp.), *Botrytis* blossom blight and fruit rot, brown leaf spot (*Septoria* sp.), and twig blight (*Diaporthe vaccinii*). The best control of these foliar diseases has been obtained by two applications of copper sulphate-lime dust (25 : 75), which may also be combined with tricalcium arsenate for the simultaneous control of insect pests in the following formulae: 20 per cent. copper sulphate, 17 per cent. tricalcium arsenate, and 63 per cent. lime, or 25, 17, and 58 per cent., respectively.

Crandall (B. S.). **Spread of Persimmon wilt.**—*Plant Dis. Reptr*, xxvii, 7–8, pp. 158–160, 1 map, 1943. [Mimeographed.]

The results of a limited survey in North Carolina from 1940 to 1942 and along some 500 miles of highway in Florida and South Carolina in 1942 indicate that the wilt disease (*Cephalosporium* sp.) of persimmon (*Diospyros virginiana*) [*R.A.M.*, xix, p. 552] has spread into new territory in the Carolinas. Within its known range it has increased in regions where the host is abundant and decreased where it is scarce.

Definition of fungicide terms.—*Phytopathology*, xxxiii, 7, pp. 624–626, 1943.

Definitions approved by the Committee on Standardization of Fungicidal Tests, appointed by the American Phytopathological Society in 1939 [*R.A.M.*, xxii, p. 258 and next abstracts], are furnished for a number of terms used in the current literature on the testing of fungicides.

The slide-germination method of evaluating protective fungicides.—*Phytopathology*, xxxiii, 7, pp. 627–632, 1943.

Specifications approved by the Committee on Standardization of Fungicidal Tests of the American Phytopathological Society [see preceding and next abstracts] and believed to embody the most effective up-to-date procedures, are given for the apparatus, mode of application, standardization of the test fungus, examination for germination, comparisons, and determination of tenacity, to be employed in connexion with the slide-germination (moist chamber) method for the evaluation of protective fungicides.

Standard laboratory Bordeaux mixture.—*Phytopathology*, xxxiii, 7, pp. 633–634, 1943.

Directions are given for the preparation of standard laboratory Bordeaux mixture to fulfil the requirements of the Committee on Standardization of Fungicidal Tests of the American Phytopathological Society [see preceding abstracts]; the required deposition and LD values after mixture are specified and the method of determining its coefficient in relation to that of the test preparations is described.

Kadow (K. J.) & Hopperstead (S. L.). **An evaluation of new spray equipment.**—*Trans. Peninsula hort. Soc.*, xxxii, 5, pp. 13–18, 5 figs., 1943.

Notes are given on the construction and performance of some new types of fruit-spraying apparatus [cf. *R.A.M.*, xxii, pp. 166, 476], including G. W. Dougherty's 'new speed sprayer', based on the principle of distributing water suspensions of spray materials with air currents induced by a propeller and directed by fins, vertical booms, and a 12-nozzle boom devised by H. Heritage. The authors conclude that for satisfactory disease control by spraying there is no substitute for thoroughness and timeliness. The speed sprayer and the vertical boom appear to be steps in the right direction.

Gassner (G.). **Zur Methodik der laboratoriumsmässigen Prüfung von Beizmitteln.** [A contribution to the technique of disinfectant trials under laboratory conditions.]—*Phytopath. Z.*, xiv, 4, pp. 303–309, 4 figs., 1943.

Nagel's method of testing fungicides for their toxicity to wheat bunt [*Tilletia caries* and *T. foetida*: *R.A.M.*, vii, p. 24] being open to criticism at one or two points, the writer proposes certain improvements in the technique, which now consists in placing the inoculated and treated seeds, embryo upwards, in a soil emulsion, where they are left until the completion of germination. Two to three days after the removal of the seeds the degree of reduction of spore germination on the submerged parts of the seed grains will give the measure of toxicity of the disinfectant. The data secured by this method in the laboratory corresponded with those obtained in simultaneous field trials. To cite some figures, entire freedom from infection in the field (spore germination totally inhibited in the laboratory or only one or two viable spores in the depressions of eight seeds) was conferred by abavit and fusariol at a dosage of 1 and 2 per cent., ceresan, germisan, and selektol at 2 per cent., abavit neu, germisan, and tillantin dusts at 200 gm., and panogen (oil) [cf. ibid., xxii, p. 164] at 200 c.c. per 100 kg. seed-grain. Very satisfactory control was also given by bigriol and higosan (2 per cent.), germisan 1 per cent., ceresan and germisan dusts (200 and 100 gm., respectively), and panogen (100 c.c.), with all of which the incidence of field infection was less than 1 per cent., and the number of spores germinating in the culture dishes negligible. The incidence of infection in the untreated control plot amounted to 53·2 per cent.

Hansen (H. N.) & Snyder (W. C.). **The dual phenomenon and sex in Hypomyces solani f. cucurbitae.**—*Amer. J. Bot.*, xxx, 6, pp. 419–422, 2 figs., 1943.

In continuation of their studies on the 'dual phenomenon' [*R.A.M.*, xvii, p. 830] the authors have examined many other fungi, especially species of *Fusarium*, and consider that the extraordinary genetic stability of the *M* type cultures constitutes strong evidence that *M* is a true mutant form from *C*. For *Hypomyces solani* f. *cucurbitae* [ibid., xxi, p. 224] the authors (abs. in *Phytopathology*, xxx, p. 787, 1940) have demonstrated that *M* and *C* types segregate in the normal 1 : 1 ratio. In further studies they show that the *C* haploid thalli of this fungus are hermaphroditic, self-sterile, and inter-fertile, whereas the *M* type has not been observed to produce sporodochia or perithecial primordia; it is assumed that the occurrence of sporodochia or primordia is determined either by a single gene or two genes located close to one another. As a result of hybridization experiments [which are described in detail] the authors conclude that the progeny of $AC \times aM$ (*A* and *a* being the two types of haploid thalli of this fungus which must be brought together to produce the sexual stage, and are sometimes referred to as compatibility groups) consist of four kinds of thalli *AC*, *AM*, *aC*, and *aM* in the normal ratio of 1 : 1 : 1 : 1. This behaviour is taken to indicate that the factors for *M* and *C* are allelomorphs and are inherited independently of the allelomorphic compatibility factors for *A* and *a*. By back-crossing the four thalli it was found

that *M* could function only as a male. It is concluded from these observations that the change of *C* to *M* is a true mutation, from the hermaphrodite to the unisexual male, and that sex and compatibility are distinct and independent characters. The authors propose the use of monoecious and dioecious for the thalli and reserve the terms homothallic and heterothallic for use only in connexion with the physiological character of compatibility. If this were done, a number of terms, e.g., sex heterothallism, physiological heterothallism, synoecism, haplosynoecism, would be reduced to synonymy.

Hamm (P.), Mitchell (J. E.), & Gottlieb (D.). **A reflector scale for measuring growth of fungi.**—*Phytopathology*, xxxiii, 7, pp. 619–620, 1 diag., 1943.

A reflector scale for the measurement of fungal growth in solid and liquid media consists of a panel of glass, scaled in millimetres, affixed to the top of a box-like apparatus, and a mirror at the base of the frame at an angle of 30°, which reflects the degree of development recorded on the panel. A movable, transparent ruler, inserted just below the panel, may be used if the glass is not ruled. A desk lamp placed above the instrument, so that its light shines through the plates placed right side up on the glass, facilitates the accurate measurement of colonies with very delicate mycelium and diffuse margins.

Wellman (F. L.). **A culture medium of Maize-meal and starch mush to replace agar for growing fungi.**—*Phytopathology*, xxxiii, 7, pp. 617–619, 1 fig., 1943.

The author has successfully employed a medium of maize meal and maize starch as a substitute for media based on agar, which is now difficult to obtain. Maize meal, 260 to 300 gm., is boiled with 1 l. water and cooked in a steam sterilizer for 10 minutes; to this is added 20 gm. maize starch stirred into 50 c.c. water. The mixture is poured into Petri dishes, which are covered and autoclaved. The same medium, thinned with 10 per cent. extra water, may be tubed; the tubes must be autoclaved and cooled in a slanting position.

Israilski (V. P.). Приобретенный Иммунитет у Растений. [Acquired immunity in plants.]—*Успехи современной Биологии.* [*Achievements of contemporary Biology*], xv, 2, pp. 162–189, 1942.

The author presents a detailed critical review of the available knowledge on the problem of acquired immunity in plants [*R.A.M.*, xvii, p. 55], referring in particular to the work of Carbone [ibid., xi, p. 798], Cappelletti (*Ann. Bot., Roma*, xvii, pp. 1–87, 1928), and Magrou [*R.A.M.*, xvii, p. 799]. A bibliography of 86 titles is appended.

Fawns (H. T.). **Food production by micro-organisms. Part I. Protein production.**—*Food Manuf.*, xviii, 6, pp. 194–198, 200, 1943.

The purpose of this series of articles is to indicate some of the main conclusions reached by microbiologists concerning the synthesis of proteins, fats, and vitamins by yeasts, moulds, and other micro-organisms. A useful survey is made of some recent noteworthy contributions to this aspect of microbic biochemistry.

Stanley (W. M.). **Viruses and the electron microscope.**—*Chron. bot.*, vii, 7, pp. 291–294, 2 figs., 1943.

Reviewing recent investigations made into plant virus diseases by various workers with the aid of the electron microscope, the author states that this instrument appears to provide, for the first time, a means of directly determining the size and shape of every virus. It has confirmed the earlier, indirect evidence that the particles of tobacco mosaic virus are rods about 15 mμ in diameter and of various lengths. Tobacco necrosis virus has been shown to be spherical in shape

and about 22 mμ in diameter. A number of these instruments are now in use throughout the United States.

Atanasoff (D.). **Virus diseases of plants: a bibliography. II Supplement.**—*Phytopath. Z.*, xii, 6, pp. 511–584, 1940.

This second supplement to the author's bibliography of the virus diseases of plants [cf. *R.A.M.*, xvii, p. 125] comprises a large number of recent additions to the relevant literature, arranged under 39 headings covering fundamental problems of the nature, structure, and properties of viruses, experimental technique, and the individual hosts of the various entities, author and general indexes being appended.

Routien (J. B.) & Dawson (R. F.). **Some interrelationships of growth, salt absorption, respiration, and mycorrhizal development in Pinus echinata Mill.**—*Amer. J. Bot.*, xxx, 6, pp. 440–451, 2 graphs, 1943.

In a study conducted in Missouri under conditions of controlled supply and availability of soil-borne nutrients, the growth and salt absorption of seedlings of *Pinus echinata* and the respiration and fermentation rates of excised root fragments were investigated in relation to mycorrhiza [*R.A.M.*, xxii, p. 34]. It was found that substantial growth and salt uptake were possible at the higher levels of base saturation of the soil in the absence of mycorrhiza, provided that the physiological balance of the soil nutrients was maintained. The development of mycorrhiza enabled the seedlings to continue normal growth and salt absorption or even to surpass the normal rates in the presence of considerable amounts of adsorbed hydrogen-ion (up to 37 per cent. of the total base exchange capacity of the soil colloids), while the absence of mycorrhiza under these conditions usually depressed both growth and salt uptake. The presence of mycorrhiza was found to increase the average rate of aerobic carbon dioxide production of each short root from nearly two to four times the normal amount according to the degree of mycorrhizal development. A mechanism for fermentation was introduced with mycorrhiza formation which exhibited a definite oxygen inhibition and, therefore, stabilized the rate of carbon dioxide production by the short roots regardless of oxygen supply. No direct evidence was obtained to indicate whether mycorrhiza formation bears a causal relationship to increased salt absorption and the latter to growth, or whether the three phenomena are linked in some other manner. It is tentatively suggested, nevertheless, that the presence of mycorrhiza enables the plant to excrete hydrogen-ion for use in base exchange reactions with the soil colloids, and that the subsequent increased supply of nutrients and their absorption by the roots may later be reflected in a greater rate of growth.

Denny (F. E.). **Suggestions on inducing early germination of Potato tubers in greenhouse tests for virus.**—*Amer. Potato J.*, xx, 7, pp. 171–176, 1943.

Detailed directions are given for the treatment at a temperature of 20° to 24° of dormant potato tubers with 38 to 40 per cent. ethylene chlorohydrin (16 hours' immersion in a solution of 30 c.c. per 970 c.c. water for cut and four days at a concentration of 1 c.c. per lb. for whole ones) to insure early germination and so facilitate the greenhouse testing of samples for virus diseases, which may be commenced with material stimulated by this means within a week or so of harvesting. In some cases, e.g., with small Irish Cobbler or Rural tubers, it is advisable to follow the ethylene chlorohydrin dip with one hour's immersion in sodium thiocyanate (10 gm. per l.). The cut-tuber method is also applicable to tubers in the later stages of dormancy (incomplete emergence). Recommendations are also made for the treatment of large quantities of whole tubers and for the labelling

of tubers and seed pieces with crystal violet ink, and a note is appended on the two strengths of ethylene chlorohydrin commercially available.

YOUNKIN (S. G.). **Purple-top wilt of Potatoes caused by the Aster yellows virus.**—*Amer. Potato J.*, xx, 7, pp. 177–183, 1943.

The writer describes fully his experiments on the transmission of the aster yellows virus by *Macrosteles divisus* from *Ambrosia artemisiifolia* to potato, on which it induces purple-top wilt symptoms, a preliminary account of which has already been noticed [*R.A.M.*, xxii, p. 269].

BONDE (R.) & SCHULTZ (E. S.). **Potato cull piles as a source of late-blight infection.**—*Amer. Potato J.*, xx, 5, pp. 112–118, 1943.

The information in this paper on the importance of potato refuse piles in the dissemination of late blight [*Phytophthora infestans*] in Maine has already been noticed from another source [*R.A.M.*, xxii, p. 400].

GARDNER (M. W.) & YARWOOD (C. E.). **Phytophthora infestans on the weed Solanum sarachoides.**—*Plant Dis. Reptr*, xxvi, 23, pp. 501–502, 1942. [Mimeographed.]

Leaf and stem infections of *Phytophthora infestans* were observed on *Solanum sarachoides* localized round volunteer potato plants showing late blight on a farm near Colma, California. In culture, mycelial growth and sporulation were typical of *P. infestans* from potato. The weed in question has previously been referred to *S. villosum*.

MILLER (R. W. R.). **Annual Report, Department of Agriculture, Tanganyika Territory, 1942.**—7 pp., 1943.

On p. 6 of this report it is stated that during 1942, potatoes in the Moshi, Arusha, and Mbulu districts of Tanganyika Territory were severely attacked by late blight [*Phytophthora infestans*], other areas being as yet, apparently, unaffected.

DOWSON (W. J.). **Spore-forming bacteria in Potatoes.**—*Nature, Lond.*, clii, 3855, p. 331, 1943.

An organism, tentatively identified by T. Gibson of Edinburgh as *Bacillus polymyxa* (Prazmowski) Migula, was responsible for the conversion of the interior of stored potato tubers into a gummy, transparent mass, the material examined by the writer being taken from a consignment submitted for inspection by the Ministry of Agriculture. On inoculation into fresh slices of potato, carrot, onion, cucumber, and iris stems, the bacterium induces complete decay, accompanied by abundant evolution of gas; on reisolation it was again inoculated into a further series of slices with similar results, the process being repeated several times at varying temperatures from that of the room to 37° C. Evidently this normal occupant of the soil is capable of pathogenicity to plants under conditions requiring closer investigation.

LIVINGSTON (J. E.). **The present status of bacterial ring rot.**—*Rep. Neb. Potato Imp. Ass.* 23, pp. 9–12, 1942.

Difficulty is occasionally experienced in the differentiation of tubers attacked by *Corynebacterium sepedonicum* from those harbouring the agent of wilt *Fusarium* [*F. solani* var. *eumartii*: *R.A.M.*, xxii, p. 448], but the two diseases may be distinguished by the following features. The discoloured ring caused by ring rot extends much further into the tuber than that produced by wilt, which seldom penetrates more than half way, if as far, while the former is unaccompanied by the water-soaking which is characteristic of the latter. The ring-rot discoloration is creamy or

lemon-yellow in contrast to the darker brown of wilt, while *F. solani* var. *eumartii* does not form the circular to irregular rotted pockets, the size of a pea or larger, of a creamy or cheesy consistency, which are found in the vascular ring and sometimes in the other tissues of tubers invaded by *C. sepedonicum*.

Formaldehyde or hypochlorite solutions have been found satisfactory for the disinfection of equipment and cellars, while sacks should be immersed in a vat of boiling water for ten minutes or steamed in a closed container. Nebraska growers are urged to aim at the complete elimination of the ring-rot pathogen from their seed stocks. So far the State, in which the incidence of infestation is comparatively low, has not had a single car-load of potatoes rejected on account of the disease.

WEBER (G. F.). **Southern blight, Corticium rolfsii, of Potato tubers.**—*Phytopathology*, xxxiii, 7, pp. 615–617, 1 fig., 1943.

Although frequent reference has been made to the occurrence of southern blight (*Corticium rolfsii*) on potato tubers in Florida and elsewhere in the south-eastern United States, the published information on the disease is so scanty that a description of the symptoms was deemed advisable. Sebago tubers harvested near Gainesville in late May, 1942, showed about 1 per cent. infection, manifested by sunken, circular, yellow to tan spots, with diffuse, brownish margins and a central speck, apparently a lenticel, 1 cm. in diameter, gradually darkening with the development of secondary organisms on the surface. The cortex surrounding the lesions was often overgrown by a thin, more or less reticulate hyphal weft closely adpressed to the surface. In advanced stages of the disease, portions of the tubers collapsed, the resultant soft areas usually being covered by cortex, which finally ruptured to disclose small, spherical, clustered, white to dark brown sclerotia. The internal enlargement of the lesions was accompanied by a complete loss of firmness of the flesh, which assumed a chalky-white, opaque appearance and a cheesy consistency. Desiccation, shrinkage, and collapse followed, the white mycelium and usually the sclerotia of the pathogen developing in the cavities thus induced.

A sufficiency of soil moisture is the decisive factor in the growth of *C. rolfsii*, and as the supply becomes depleted in dry weather, the level of the fungus apparently shifts from the surface of the dry, sandy local soils to the deeper layers, so that the tubers are exposed to infection instead of the stem and aerial organs, which suffer in normal seasons.

JAARSVELD (ALIDA). **Der Einfluss verschiedener Bodenpilze auf die Virulenz von Rhizoctonia solani Kühn.** [The influence of various soil fungi on the virulence of *Rhizoctonia solani* Kühn.]—*Phytopath. Z.*, xiv, 1, pp. 1–75, 11 figs., 15 graphs, 1942.

Some of the writer's exhaustive, fully tabulated studies on the influence of various soil fungi on the pathogenicity of *Rhizoctonia* [*Corticium*] *solani* to Lungbok Chinese cabbage seedlings were carried out at the Willie Commelin Scholten Phytopathological Laboratory, Baarn, Holland, and the remainder at the Federal Technical College, Zürich, Switzerland. Ten strains of *C. solani* were used in preliminary experiments, of which six were newly isolated (four from potato and two from coffee seedlings and *Cinchona*, respectively); the remainder, including the one isolated by Van Luijk in 1931 from grass seed [*R.A.M.*, xiv, p. 240] and used in the majority of the present trials on account of its extreme virulence, and the non-parasitic soil fungi were obtained from the Centraalbureau voor Schimmelcultures, Baarn.

Previous investigations on the subject of the work are reviewed, the validity of most of the results being regarded as questionable owing to the alleged omission

of precautions to ensure completely sterile experimental conditions, which were provided in the writer's tests by the use of culture tubes sealed with plugs of cotton wool. The strongest antagonistic effect on sterilized sand or soil cultures of *C. solani* was exerted by two strains of *Trichoderma lignorum* [*T. viride*: ibid., xvi, p. 556], followed by *Pyronema confluens*, *Cylindrocarpon didymum*, *Penicillium expansum*, *Cladosporium herbarum*, and *Absidia spinosa*. In combinations of *Corticium solani* with two to four of its antagonists, the total inhibitory effect on the pathogen was greater than that produced by one alone. The inclusion of *Cylindrocarpon didymum* with other soil fungi mitigated the action of the latter, notwithstanding its independent antagonism to the parasite. The results of pot experiments generally confirmed those of the laboratory tests.

The antagonistic effects of *A. spinosa*, *C. didymum*, *Pyronema confluens*, and strain B of *T. viride* reached a climax at temperatures approaching the optimum for the development of the individual fungi, i.e., 24° C., 21°, 27°, and 21° to 33° on solid media, and 27°, 24°, 21° to 30°, and 15° to 30° on liquid media. The cabbage seedlings made good growth between 9° and 30°.

Not only the living soil fungi, but also their filtrates, exercised an adverse influence on the growth of *Corticium solani* and weakened its pathogenicity to the cabbage seedlings. As a rule, no pseudosclerotia developed in undiluted, only a few in weakly diluted, and many in strongly diluted filtrates.

In combined cultures of *C. solani* and the various soil fungi mutual aversion assumed several forms, but no case of hyperparasitism was observed.

MUJICA (F.). **Susceptibilidad de variedades de Papas a la sarna polvorienta causada por la Spongospora subterranea (Wallr.) John.** [Varietal susceptibility of Potatoes to the powdery scab caused by *Spongospora subterranea* (Wallr.) John.]—*Bol. Sanid. veg., Santiago*, ii, 1, pp. 17–19, 1942.

In a trial of 51 potato varieties for their reaction to powdery scab (*Spongospora subterranea*), the six most resistant were Huevo Los Riscos, Chapeda Colorada, Mantequilla Los Riscos, Huevo Chiloé, Industrie, and Volcán, with 0, 0, 0, 0·82, 4·50, and 5·63 per cent. infection, respectively, compared with an incidence of up to 60·28 per cent. in the remainder.

SORENSEN (H. G.). **Crown budding for healthy Hevea.**—*Agric. Amer.*, ii, 10, pp. 191–193, 5 figs., 1942.

An outstanding feature of the co-operative Western Hemisphere programme for the establishment of a plantation rubber industry in Latin America, undertaken in 1940, was an energetic campaign against the destructive and hitherto uncontrollable leaf blight (*Dothidella ulei*) [*R.A.M.*, xx, p. 223]. Many resistant individuals exist in nature, but as a rule such trees are poor yielders, and the ultimate objective of the plant-breeders concerned with this problem is the development of clones or strains combining the capacity to withstand infection by *D. ulei* with heavy cropping. This has been partly accomplished; in the meantime a promising method of using eastern strains is the bud-grafting of resistant crowns on to a selected trunk originating from a bud of a high-yielding stock affixed to a seedling. The outcome of this combination is a tripartite tree, consisting of a root, a trunk, and a crown all derived in the first instance from different seeds. Similar experiments have been conducted [in Java] with a view to the control of mildew (*Oidium heveae*) [ibid., viii, p. 461]. Most of the 53 Far Eastern clones imported into Brazil in 1934 by the Ford Company, which initiated the Latin-American rubber scheme in 1929, proved to be highly susceptible to blight, as also did the Tapajoz River (Amazon Valley) seedlings used, together with some highly resistant individuals from Belém and Acre, for the first plantings. This resistant material provided selections which are now being rapidly multiplied both for planting and crown-

budding. Some of the early crown-budding experiments were made with *Hevea guianensis*, *H. spruceana*, and other species, but it is now considered safer to use only *H. brasiliensis* for top-working so as to avoid any deterioration in the quality of the latex.

Campbell (W. A.), Leach (L. D.), Presley (J. T.), & Snyder (W. C.). **Some diseases of Guayule in California.**—*Plant Dis. Reptr*, xxvii, 2, pp. 63–66, 1943. [Mimeographed.]

Nursery and field plantings of guayule (*Parthenium argentatum*), now being extensively cultivated in California for the production of rubber, have shown the presence of root rots (one type associated with *Phytophthora* sp., another with *Pythium* sp. and a third with a *Rhizoctonia* of the *R.* [*Corticium*] *solani* type), wilt (*Verticillium albo-atrum*), top rot (*Sclerotinia sclerotiorum*, *S. minor*, and *Botrytis cinerea*), and collar rot (? *Phoma* sp.). Most of these organisms are favoured by wet conditions, and would probably be of little or no importance to guayule in its natural desert habitat.

Ezekiel (W. N.). **Crown rot and root rot of Guayule.**—*Plant Dis. Reptr*, xxvii, 1 pp. 2–8, 1 map, 1943. [Mimeographed.]

Experimental plantings of *Parthenium argentatum* in Texas were attacked by a form of crown rot, the cause of which was not ascertained, and by root rot (*Phymatotrichum omnivorum*), but not by rust (*Puccinia parthenii*), previously recorded in North America. The crown rot occurred in two out of four fields and caused heavy loss. It appeared to be, primarily, a disease affecting large, vigorously growing plants. The injury was found to centre round the crown, where the cortex and deeper tissues were blackened and decayed. Individual shoots, rather than the whole plant, appeared to be attacked separately at the crown. Many plants displayed growth cracks about the enlarged crown.

In a one-acre planting, plants eight to nine months old were found attacked by *Phymatotrichum omnivorum*, the dead plants occurring in groups of one to four along the rows. Rather less than a month later, about 6 per cent. of the plants were observed to be dead, the general appearance agreeing with a diagnosis of *P. omnivorum* root rot. This appears to be the only record of this fungus on guayule under field conditions. In inoculation tests under conditions strongly favouring infection nearly one-half the young plants inoculated succumbed.

Streets (R. B.). **The susceptibility of Guayule to Phymatotrichum root rot.**—*Plant Dis. Reptr*, xxvii, 2, pp. 66–68, 1943. [Mimeographed.]

In a test carried out in southern Arizona, some 10,000 guayule (*Parthenium argentatum*) plants were set in an area of about $1\frac{1}{2}$ acres. Two-thirds of plot 1, previously planted to cotton, was heavily infected by *Phymatotrichum* [*omnivorum*: see preceding abstract], one-third of plot 2, previously planted to lucerne, was very heavily infected by the same fungus, and the remainder was free from the root rot. The soil was a light sandy loam. The one-year-old seedlings were planted on 17th and 18th April, and irrigated at once, after which they received a light irrigation every seven to ten days for six weeks. Until second-year data become available growers are advised not to plant this host on irrigated lands known to be infected with the fungus.

Niethammer (Anneliese). **Ernährungsphysiologische Untersuchungen an Fusarien, unter Hervorhebung der Ölspeicherung.** [Nutritional-physiological studies on *Fusaria*, with emphasis on oil secretion.]—*Arch. Mikrobiol.*, xiii, 2, pp. 140–149, 1 fig., 1942.

Continuing her studies at the German Technical College, Prague, Czecho-

slovakia, on species of *Fusarium* isolated from various types of soil [*R.A.M.*, xxii, p. 406], the writer describes the cultural characters, with special reference to oil secretion, on ten nutrient media of *F. sambucinum*, *F. bulbigenum* and its vars. *blasticola* and *tracheiphilum*, *F. solani* and its var. *martii*, and *F. oxysporum* and its var. *aurantiacum*. Natural cellulose-containing plant remains, such as pea and bean straw and potato foliage, were particularly suitable as substrata. On all the media tested heavy deposits of oil were observed in the hyphae, and frequently also in the conidia and chlamydospores, of the species under investigation.

Perotti (R.). **Gli studi italiani sul fondamento dell' impiego del boro in agricoltura.** [Italian studies on the basis of the use of boron in agriculture.]—*Phytopath. Z.*, xii, 4, pp. 421–424, 1940. [German summary.]

Italian investigations on the uses of boron in agriculture are briefly discussed, with special reference to those conducted at the Pisa Phytopathological Institute, near which (at Larderello) is the most important source of boron in the world. The researches relate to the presence of boron in the soil and in plant tissues, the action of the element on the soil microflora and higher plants, and in particular to its application as a fertilizer and chemotherapeutant.

Katznelson (H.) & Richardson (L. T.). **The microflora of the rhizosphere of Tomato plants in relation to soil sterilization.**—*Canad. J. Res.*, Sect. C, xxi, 8, pp. 249–255, 1943.

In qualitative and quantitative studies of the soil and root microflora of greenhouse tomatoes, carried out at the Dominion Laboratory of Plant Pathology, St. Catherines, Ontario, examination of samples from soils sterilized with formaldehyde, chloropicrin, or steam, and of the unsterilized control, invariably showed greater numbers of fungi, bacteria, and Actinomycetes in rhizospheres than in soils apart from the root. Sterilization with chloropicrin and formaldehyde resulted in large increases in numbers of fungi in both rhizospheres and soils, but steam had a deleterious effect lasting for over three months. Bacteria were considerably more numerous on infected than on healthy roots. There was a definite tendency for bacteria with simple food requirements and those stimulated by amino acids to predominate in the rhizospheres, and for those with more complex nutritional needs to predominate in other parts of the soil.

Conners (I. L.). **Rusts and other diseases of Safflower.**—*Plant Dis. Reptr*, xxvii, 9, pp. 194–199, 1943. [Mimeographed.]

In this paper, reprinted from a mimeographed unnumbered publication issued by Central Experimental Farm, Ottawa, 10th March, 1943, the author deals with rusts of safflower (*Carthamus tinctorius*) of which only one, *Puccinia carthami* [*R.A.M.*, xxi, p. 405], has been found in Canada (in Manitoba and Saskatchewan, 1942). An annotated list is also given of the diseases of the crop previously noted in this *Review*, together with *Gloeosporium carthami* [syn. *Marssonia carthami*: *Mycologia*, xii, p. 333, 1920] from Japan and the United States.

Rayss (T.). **On some lower fungi of Palestine.**—*Palest. J. Bot.*, J Ser., ii, 4, pp. 247–249, 2 figs., 1942.

This further critically annotated contribution to the mycoflora of Palestine [*R.A.M.*, xx, p. 495] comprises seven species, two of which are new. Mention may be made of *Urophlyctis alfalfae* on a new host, *Medicago rotata* [cf. ibid., xvi, p. 563], and of the detection of *U. pulposa*, a destructive parasite of cultivated beets [ibid., x, p. 7], on the leaves, stems, and petioles of wild beet along the irrigation ditches in a clover field. Since the weed may serve to perpetuate the

pathogen from year to year, it should be eradicated from the vicinity of cultivated plantings.

Cummins (G. B.). **Annotated check list and host index of the rusts of Guatemala.**—*Plant Dis. Reptr, Suppl.* 142, pp. 79–131, 1 map, 1943. [Mimeographed.]

Of the 1,858 collections of Guatemalan rusts, comprising 369 species, enumerated in the present list on 611 hosts, P. C. Standley was responsible for 742 (1939 to 1941), E. W. D. Holway for 600 (1914 to 1917), Kellerman for 243 (1905 to 1908), and J. R. Johnston for 224 (1937 to 1941). *Puccinia antirrhini* (a new record) is stated to be extending its distribution wherever *Antirrhinum majus* is grown.

Cooke (W. B.). **Additions to the host index of fungi of Mount Shasta, California—II.**—*Plant Dis. Reptr*, xxvi, 11, pp. 253–259, 1942. [Mimeographed.]

Several more records, and one correction to the first list, are contained in this addition to the author's host index of fungi of Mount Shasta, California [*R.A.M.*, xx, p. 323].

Hills (Patricia L.). **The mycelium of the Uredinales.**—*Amer. Midl. Nat.*, xxviii, 3, pp. 756–760, 5 figs., 1943.

The examination at the State University of Iowa of five species of rusts, namely, *Pucciniastum agrimoniae* from *Agrimonia gryposepala*, *Coleosporium solidaginis* from *Solidago canadensis*, *Melampsora medusae* from poplar (*Populus deltoides*), *Tranzschelia* [*Puccinia*] *pruni-spinosae* from *Prunus serotina*, and *Puccinia malvacearum* from hollyhock revealed the presence in all of structures analogous to those described by Voss (*Ber. dtsch. bot. Ges.*, xxi, pp. 366–371, 1903) as clamp-connexions. However, in the light of more recent knowledge concerning anastomoses, the elements in question are interpreted as small hyphal loops or incompletely formed septa.

Gadd (C. H.). **Shot-hole borer and wood rot.**—*Tea Quart.*, xvi, 1, pp. 6–9, 1943.

After stating that the discoloration of the woody parts of the tea bush in which the shot-hole borer *Xyleborus fornicatus fornicatior* makes its galleries is sometimes interpreted as the beginning of wood rot [cf. *R.A.M.*, xv, p. 747], and distinguishing between this condition, which is a penetration into the living wood, and die-back, which seldom extends below the uppermost new growth, the author describes an experiment made to ascertain whether the amount of rot developing in a given time after pruning is greater in borer-infested than in non-infested branches. In three fields in the Passara district, the mean length of die-back in 35, 50, and 50 pruned infested stems was, respectively, 0·76, 0·99, and 0·75 in., while in pruned uninfested stems it was 0·41, 0·54, and 0·27 in., respectively. The mean length of wood rot in pruned infested stems was, respectively, 1·1, 0·22, and 0·65 in., while in the uninfested it was, respectively, 0·63, 0·12, and 0·33 in. The shot-hole borer frequently enters the stem at the leaf scar and thereby damages the bud above, preventing it breaking after pruning; this results, as the experimental data show, in greater die-back. It also appears that the wood surrounding the galleries is either rendered more susceptible to attack by wood-rotting fungi or can be reduced more rapidly by such organisms to a friable condition than wood free from borer attack.

Bond (T. E. T.). **Deficiency diseases and the role of the 'minor elements' in plant life.**—*Tea Quart.*, xvi, 1, pp. 9–15, 1943.

In this discussion of the part played by the so-called minor elements in plant nutrition the author discusses those which have been shown to be essential, the quantities of them that plants require, their availability in the soil, and the

diagnosis and cure of diseases due to a deficiency of them. Reference is made in this connexion to tea yellows in Nyasaland, caused by sulphur deficiency [*R.A.M.*, xii, p. 537], and to other deficiency diseases of the same host in Java [ibid., xx, p. 497].

PRICE (W. C.) & SPENCER (E. L.). **Accuracy of the local lesion method for measuring virus activity. II. Tobacco-necrosis, Alfalfa-mosaic, and Tobacco-ringspot viruses.**—*Amer. J. Bot.*, xxx, 5, pp. 340–346, 1943.

This paper gives more results of the writers' virus activity-measuring experiments [*R.A.M.*, xxii, p. 376]. When the solution tested was from 25 to 100 per cent. of the standard virus preparation, the mean (and greatest) errors were 11 (and 32) per cent. for tobacco necrosis virus, 18 (40) per cent. for lucerne mosaic virus, and 14 (36) per cent. for tobacco ring-spot virus.

PRICE (W. C.). **Severity of curly top in Tobaccos affected by site of inoculation.**—*Phytopathology*, xxxiii, 7, pp. 586–601, 1 fig., 1943.

The symptoms developing on Turkish tobacco grafted with scions from tobacco plants recently infected by the sugar beet curly top virus ranged from mild through intermediate to severe, and similar results were obtained in experiments with scions from tobacco plants that had recovered from the disease. In general, the symptoms were rather more severe in the case of recently infected than in that of recovered plants, but the differences were not consistent. Tomato plants grafted with scions from recovered tobacco either contracted severe curly top symptoms, usually culminating in death, or showed no sign of infection (15 out of 44), the latter result being attributable to failure of the virus to pass the graft union or reach the growing points of the grafted plant.

The intensity of the symptoms developing in tobacco plants into which the curly top virus was introduced through the vector, *Eutettix tenellus*, depended in part on the portion of the plant utilized for the insect's food supply, severe infection following contact with carriers fed on tissues near the growing point, in contrast to the mild or moderate manifestations produced by insects confined to single leaves or areas of the stem well below the growing point. Transmission of curly top to old tissues by *E. tenellus* was thus comparable to the same process effected by grafting with scions from recently diseased or recovered tobacco plants. These results are considered to throw doubt on the supposed transmission of protective substances through the graft union [*R.A.M.*, xix, p. 304].

MCKINNEY (H. H.). **Reaction of resistant Tobaccos to certain strains of Nicotiana virus 1 and other viruses.**—*Phytopathology*, xxxiii, 7, pp. 551–568, 3 figs., 3 diags., 1943.

When viruses of the yellow mosaic mutants were inoculated into the T.I. 448A tobacco selection [*R.A.M.*, xxii, p. 376], secondary chlorotic spots seldom appeared in the new leaves until they had attained a quarter to half their growth. The first symptoms usually develop at or near the leaf tip, the spotting proceeding downwards as the leaf grows. The spread of chlorosis from the initial foci tends to reach its maximum concentration in the leaf margins and apex and is not correlated with the rate of cell division, which is slower towards the tip than in the lower margins. From the available evidence it appears safe to conclude that the secondary chlorotic spots in T.I. 448A and Ambalema are a sequel to the destruction of the chlorophyll rather than to the prevention of chlorophyll synthesis. The mosaic pattern produced by the yellow mutants on dark green varieties is usually less permanent than that developing on the foliage infected by common mosaic, the former undergoing modifications coinciding with the advance of delayed chlorosis into the green zones. None of the mutants from the

common mosaic virus were more active invaders of tobacco leaves than the parent, and some, in fact, seemed less efficient in this respect. T.I. 448A contracted neither local nor systemic necrosis on infection by *Nicotiana* virus 1 or any of its mutants, while on Ambalema no systemic necrosis occurred and the minute necrotic lesions were localized.

In comparative experiments with the mutants *BSY* [ibid., xxi, p. 268], type B [ibid., xv, p. 322], and the 'white' virus collected by W. D. Valleau in the field [ibid., xx, p. 499] on T.I. 448A and *N. glauca*, the exact order of pathogenicity of the different strains for one host is not reflected in the other, nor does the latter react uniformly to various collections of the light green mosaic viruses falling within the common mosaic group. It is thus apparent that a single virus strain cannot serve to indicate the precise composition of the genes conferring resistance to mosaic in plants possessing this property. Plants of T.I. 448A and Ambalema infected with *Nicotiana* virus 1 have never shown yellow mosaic mutation spots, and since *Nicotiana* virus 1 appears to interfere with the unlimited increase and spread of its mutants, it is highly probable that these resistant tobaccos are very poor natural reservoirs for the mutants. Should mutants arise that suppress *Nicotiana* virus 1, difficulties may be encountered with all resistant tobaccos now in use.

It is concluded from the results of these and previous studies that T.I. 448A is one of the best genotypes, if not unequalled, among those at present available for use in breeding for resistance to the common mosaic virus and its variants.

Reynard (G. B.). **'Red ring' of Tomato stems caused by an insect, Cyrtopeltis varians (Dist.), at Charleston, S.C.**—*Phytopathology*, xxxiii, 7, pp. 613–615, 1 fig., 1943.

Attention is drawn to the implication of a bug, *Cyrtopeltis varians*, in the etiology of 'red ring' of tomato stems and petioles at Charleston, South Carolina, in 1941 and 1942, a similar injury having also been reported from Texas and Arizona. The stems and petioles of the upper branches of the plants were encircled by reddish-brown, raised marks and often collapsed on bending. The symptoms are suggestive of a disease of which it is thought possible the insects may be vectors.

Linn (M. B.) & Anderson (H. W.). **Spread of the common Tobacco-mosaic virus in Tomato fields by means of vine lifters.**—*Plant Dis. Reptr*, xxvi, 22, p. 470, 1942. [Mimeographed.]

During tomato dusting operations against blight (*Septoria*) [*lycopersici*], the use of vine-lifters on the dusting equipment appeared to be responsible for an unusual amount of mosaic. No virus apart from the tobacco mosaic virus, typical strain, was present. Some 5 per cent. of the plants, it was estimated, showed mosaic at the time of the first dusting. At the first picking an average of 95 per cent. of the plants in the dusted, and 43 per cent. in the undusted, rows showed the condition. It would appear that under certain circumstances, the use of vine-lifters may result in such severe mosaic infection as to nullify any benefits from the use of the lifters and even from the dusting.

Samson (R. W.). **Single-virus streak of greenhouse Tomatoes.**—*Plant Dis. Reptr*, xxvi, 16, pp. 361–364, 1942. [Mimeographed.]

In May, 1942, greenhouse tomatoes at Indianapolis, Indiana, were observed to be affected by a disease resembling streak [see next abstract]. From a trace to 20 per cent. of the plants showed necrotic streaking of the upper portions of the stems and of the petioles and major leaf veins of the adjacent leaves. Brown, necrotic areas were present in the pith of the streaked stems. Many more plants showed only a limited amount of leaf and petiole necrosis in addition to sharply

defined bleached or chlorotic areas. Traces of leaf necrosis were found on plants otherwise showing only a mosaic mottling. Almost all plants showed mosaic mottling on the younger leaves. Some of the affected plants bore distorted fruits showing depressed, corky spots and broad streaks.

Observations made a month or so before indicated that the necrotic phase was more severe when the plants were young, with only two or three clusters of fruit set, and rapidly growing. This stage had coincided with fewer hours of sunlight and lower greenhouse temperature. With better weather, additional fruit set, maturity of the first fruits, and narrowing, apparently, of the carbon–nitrogen ratio in the plants, the development of additional necrosis became arrested, and later growth showed only mosaic symptoms.

These symptoms led the author to conclude that the disease was single virus streak, a view which preliminary inoculation experiments appeared to confirm. Young tomato plants inoculated with unheated extracts from 37 affected plants all developed mosaic mottling, in most cases accompanied by yellow mottling. Only two of 222 tomato plants developed any necrosis. Turkish tobacco plants inoculated with unheated extracts from 15 of the 37 collections developed a very characteristic disease, in the form of extensive necrosis of the inoculated leaves, indefinite chlorosis and necrotic flecking of the next younger leaves, and mottling of the still younger ones. This condition resembled that produced on the same host by the virus from *Plantago* [*lanceolata*: *R.A.M.*, xxi, p. 227]. Turkish tobacco plants inoculated with 18 of the remaining collections developed a disease closely resembling common tobacco mosaic. The four remaining collections gave rise to local, necrotic lesions and a systemic tobacco-mosaic type of mottling without necrosis.

The writer tentatively concludes that at least two viruses were present in the 37 collections, both being strains of tobacco mosaic virus and that both were present in some of the tomato plants. The paper concludes with suggestions on control.

Linn (M. B.) & Anderson (H. W.). **A single-virus streak disease of greenhouse Tomatoes in Illinois.**—*Plant Dis. Reptr*, xxvi, 21, pp. 452–454, 1942. [Mimeographed.]

In May, 1942, some 90 per cent. of the tomatoes in a greenhouse near Kankakee, Illinois, were reported to be affected with a virus disease, resembling one described by Samson on greenhouse tomatoes in Indiana [see preceding abstract] as caused by a single-virus streak strain of tobacco mosaic, except that, in the case of the Illinois disease, the fruits appeared to remain unaffected. The affected plants from Illinois showed faint, necrotic streaks on the upper stems, petioles, and leaf veins, which were associated with a yellowing or bleaching mosaic pattern, this last being the most conspicuous symptom. The disease reappeared in September, affecting nearly all the tomatoes of the autumn planting, in spite of the fact that the soil had been steam-sterilized and no other plants had been grown in it between the tomato crops.

In tests carried out with juice from affected plants, diluted 1 : 1 with water and exposed for 10 minutes to temperatures ranging from 45° to 85° C. at 10° intervals, young tomato plants were inoculated, other plants being inoculated with juice not exposed to heat. All the inoculated plants showed yellow mottling within 10 days, and there was no appreciable difference between the symptoms produced by the heated and the unheated extracts.

When tomato plants inoculated with untreated juice were transplanted to the field three weeks after mottling had developed, necrotic streaking appeared on the leaves and stems in two or three weeks, but the fruits remained normal.

Alexander (L. J.) & Lincoln (R. E.). **A survey of the genus Lycopersicon for resistance to the important Tomato diseases occurring in Ohio and Indiana.**—*Plant Dis. Reptr, Suppl.* 136, pp. 51–85, 1942. [Mimeographed.]

The results of tests on the reactions of 448 tomato introductions of the Bureau of Plant Industry, United States Department of Agriculture, to the principal diseases affecting the crop in the north-central region of the United States are discussed and presented in tabular form. Of the five species of *Lycopersicum* constituting the experimental material, *L. peruvianum* provided the most valuable source of resistant selections, particularly as regards tobacco mosaic and leaf mould (*Cladosporium fulvum*), some of the lines being also able to withstand infection by *Fusarium bulbigenum* var. *lycopersici, Septoria lycopersici, Alternaria solani,* and *Phytomonas* [*Xanthomonas*] *vesicatoria.* A high degree of resistance, approximating to immunity in many cases, to mosaic and the defoliation diseases was shown by *L. hirsutum,* while *L. pimpinellifolium* sustained little damage from *F. bulbigenum* var. *lycopersici* or *C. fulvum.* Only a few lines of *L. esculentum* showed any promise from the standpoint of breeding for resistance to the major diseases, though both this species and *L. pimpinellifolium* gave some indication of freedom from ripe fruit rot (*Colletotrichum phomoides*). None of the introductions was conspicuously resistant to *P. michiganensis* [*Corynebacterium michiganense*] or *P.* [*Bacterium*] *solanacearum.*

Doolittle (S. P.). **Tomato diseases.**—*Fmrs' Bull. U.S. Dep. Agric.* 1934, 83 pp., 47 figs., 1 map, 1943.

Semi-popular notes are given on the bacterial, fungal, virus, non-parasitic, and miscellaneous diseases affecting United States tomato crops, which in 1940 occupied over 600,000 acres of an estimated value of $56,000,000, with recommendations for their control and a key to facilitate diagnosis.

Leach (J. G.) & Berg (A.). **Tomato tip-blight found in West Virginia.**—*Plant Dis. Reptr,* xxvi, 12–13, p. 278, 1942. [Mimeographed.]

Woods (M. W.) & Cox (C. E.). **A virus disease of Tomato, new to Maryland, that resembles tip-blight.**—*Trans. Peninsula hort. Soc.,* xxxii, 5, pp. 69–70, 1943.

Both these papers record tomato tip blight [*R.A.M.,* xviii, p. 420], caused by a strain of the tomato spotted wilt virus, from West Virginia, and, according to the second, probably from Maryland also. These are the first records of the disease from the eastern regions of the United States.

Cass Smith (W. P.). **Wilt diseases of Tomatoes.**—*J. Dep. Agric. W. Aust.,* Ser. 2, xxi, 1, pp. 45–53, 6 figs., 1943.

Tomato spotted wilt was first recorded in Western Australia in 1923, when it was observed in the metropolitan area; since then it has spread to many other parts, including the chief tomato-growing districts. Losses in commercial crops vary greatly from year to year, but on an average it is easily the most serious disease affecting tomatoes. Suggestions are made for controlling the disease in commercial fields and gardens by methods designed to eradicate weeds and the insect vector.

Wilt due to *Fusarium* [*bulbigenum* var.] *lycopersici* has been reported from all the principal tomato-growing areas of the State, and ranks second in importance to spotted wilt, though the economic losses due to it are much less serious. The control methods recommended are as follows: seed should be from healthy plants or disinfected in mercuric chloride 1 : 3,000; fresh seed-beds should be prepared each year, and rotation should be practised. Infected plants should not be fed to stock. Affected plants should be removed and destroyed during the growing

season, and when the season is over the crop remains should be burnt, the stakes and seed-bed framework being sterilized at the same time. Varieties said to be resistant, and which growers could try, include Marglobe, Potentate, Rutgers, Break o' Day, Marhio, Australian Earliana, and Early Red Dwarf.

Tomato bacterial wilt (*Bacterium solanacearum*) is of minor importance in Western Australia compared with *Fusarium* or spotted wilt. Recorded in the State many years ago, it has since been observed, and that infrequently, only in the Geraldton and metropolitan district. Control measures are the same as for *F. b.* var. *lycopersici*, though resistant varieties are not available. Chewing insects must be combated, and the workers' hands should be washed in warm, soapy water after handling diseased plants.

McNew (G. L.). **Phytophthora infestans was destructive on Tomatoes in New York State during 1942.**—*Plant Dis. Reptr*, xxvi, 23, pp. 488–492, 1942. [Mimeographed.]

During 1942, when infection of tomatoes by *Phytophthora infestans* [*R.A.M.*, xxi, pp. 474, 497; xxii, p. 45] reached epidemic proportions in western New York, detailed records were taken in a field planted to the Stokesdale variety, where five copper compounds were under test. Four applications of the fungicides were made at 11-day intervals during July and August, 200 gals. of spray being used per acre. The fungus was noted on an occasional tomato on 25th August, and by 10th September on about 2 per cent. of the fruits. The results showed that the difference between a plot sprayed with Bordeaux (4–2–50) and the unsprayed controls amounted to over 6 tons or 73·1 per cent., which represents a cash loss from the disease of about $110 per acre. Infection by *P. infestans* was directly responsible for a loss of 2·41 lb. of ripe fruit per plant, equivalent to 6,999 lb. per acre, and to this should probably be added about half the rotted fruit, not definitely identified as infected by *P. infestans*. The unsprayed plants averaged a loss of 5·4 lb. per plant from soft rot [cause unspecified], as against only 2·97 lb. for the sprayed, which gives an additional balance of 2·43 lb. (equivalent to 7,057 lb. per acre) in favour of the sprayed plants. If the remainder of the crop had been allowed to ripen, the loss from *P. infestans* would have been even greater, as 38·7 per cent. of the unsprayed unripe fruits and 2·7 per cent. of the sprayed unripe fruits showed infection. Copper oxychloride-sulphate, Tennessee tribasic copper sulphate, and copper compound A were approximately as effective as Bordeaux mixture, and yellow cuprocide only slightly less so.

Ehrlich (J.). **Recently active leaf diseases of woody plants in Idaho.**—*Plant Dis. Reptr*, xxvi, 18, pp. 391–393, 1942. [Mimeographed.]

In these notes on leaf diseases of woody plants in Idaho during 1941–2 the author states that every specimen of larch (*Larix occidentalis*) leaf examined microscopically showed the fruiting structures of *Meria laricis* [*R.A.M.*, xv, p. 761]. This fungus does not appear to have been recognized before in North America, but there can be no doubt that it is firmly established in the Pacific Northwest. Necrosis of the needles of lodgepole pine (*Pinus contorta* var. *latifolia*) was commonly associated with an apparently undescribed species of *Hendersonia*. *Chloroscypha seaveri* was repeatedly found associated with the death of *Thuja plicata* twigs. *Fusicladium radiosum* (= *Napicladium tremulae*, conidial stage of *Didymosphaeria populina* [ibid., xix, p. 51]) was aggressive in the leaves and twigs of golden aspen (*Populus tremuloides* var. *aurea*). The uredo- and teleuto-stages of *Melampsora albertensis* developed so intensely on the same host, that the foliage had turned yellow and dried by midsummer. Leaf spot (*Septoria alnifolia*) was abundantly present on Sitka alder (*Alnus sinuata*) in the summer of 1942, though, apparently, not recorded before in Idaho.

ZOGG (H.). **Untersuchungen über die Gattung Hysterographium Corda, insbesondere über Hysterographium fraxini (Pers.) de Not.** [Studies on the genus *Hysterographium Corda*, particularly on *Hysterographium fraxini* (Pers.) de Not.]—*Phytopath. Z.*, xiv, 4, pp. 310–384, 19 figs., 1 diag., 27 graphs, 1943.

The first part of this comprehensive paper gives the results of biological, pathological, and cytological studies at the Federal Technical College, Zürich, on *Hysterographium fraxini*, while the second and third comprise studies on the taxonomy of the genus *Hysterographium* and of the Hysteriales in general, respectively.

H. fraxini is a non-specialized, facultative saprophyte, which may be responsible for extensive damage to ash (*Fraxinus excelsior* and *F. ornus*) trees in Switzerland under conditions adverse to the host, e.g., humid, sheltered situations, or waterlogged soils. The fungus enters branches of any age through fresh wounds in the spring and at first develops saprophytically, but with the expansion of the leaves it encroaches on the surrounding living tissue, spreading both upwards and downwards and turning the cortex yellow, later reddish-brown. The destruction of the underlying cambium induces a cortical depression. Towards the end of the summer the leaves above the site of infection begin to wither, since by this time the branch is almost completely girdled. Under favourable temperature and moisture conditions the fungus then proceeds downwards, killing the cells down to the fork of branch and trunk. In vigorous trees the formation of callus between the upper and lower parts of the branch arrests further growth, which in any case ceases in the late autumn at a temperature of 3° C. Re-infection can occur only through a fresh injury in healthy trees, but in those weakened by various physiological factors, the attacks of the beetle, *Hylesinus fraxini*, or bacterial diseases, no callus is formed and the fungus is able to pass direct from the already invaded branches to sound ones and finally to the trunk.

A single ascospore culture of *Hysterographium fraxini* generally produces fruit bodies with microconidia and sometimes asci and spores. The microconidia germinate and produce mycelium, but not asci. Inoculation experiments with monoascospore cultures were successful on ash, olive, lilac, *Lonicera tatarica* and *L. alpigena*, *Prunus fruticosa*, apple, vine, birch, alder (*Alnus viridis*), beech, oak, spruce (*Picea excelsa*), and larch, with the production on each of these (as well as on certain other hosts) of microconidia and hysterothecia.

After examination of material under 28 specific names, the author recognizes only five of them as valid, namely, *H. fraxini*, *H. flexuosum*, *H. formosum*, *H. elongatum*, and *H. mori*.

WALTER (J. M.), MAY (C.), & COLLINS (C. W.). **Dutch Elm disease and its control.**—*Circ. U.S. Dep. Agric.* 677, 12 pp., 11 figs., 1943.

Elm trees being largely used in the north-eastern United States and elsewhere for the camouflage of cities, factories, military installations, highways, and the like, the Federal control programme during war-time is being directed towards the arrest of the spread of the causal organism of Dutch elm disease, *Ceratostomella ulmi*, in the known foci of infection and its destruction in isolated areas. It is becoming increasingly incumbent on private owners to protect their elms and carry out the sanitary measures necessary to restrict the disease, and the information here supplied is designed for their assistance in this work. The part played by the European and native elm bark beetles, *Scolytus multistriatus* and *Hylurgopinus rufipes*, respectively, in the transmission of the disease is explained, and notes are given on varietal reaction to the fungus. The recovery of affected trees, even of susceptible species, is fairly frequent if they can be protected against beetle infestation during the period of reduced vitality caused by the disease. The most damaging inoculations by the insects are those effected by the overwintering brood emerging during

May and June, so that before this time all infested wood should be burned, decorticated, or sprayed in the interval between the bursting of the leaf buds and the formation of shoots 3 in. long on American elms with fuel oil (26° to 28° Baumé) and monochloronaphthalene (12 : 1) or fuel oil and ortho-dichlorobenzene (4 : 1), using 2½ to 3 gals. for one stacked cord of wood. The same treatment may be applied to freshly felled infected wood at any time from May to September. Pruning may also be carried out at any season, and is particularly advisable in the case of old and valuable trees. All elms within 25 ft. of a removed diseased tree should be watched for several years for the development of infection on account of the common occurrence of root connexions between trees at this distance apart. It is of the utmost importance that elm wood should never be piled in the open without peeling or spraying with a bark beetle-repellant, since it constitutes an even more effective source of inoculum than standing dead trees owing to its high moisture content.

Crandall (B. S.). **Thyronectria disease of Honey Locust in the South.**—*Plant Dis. Reptr*, xxvi, 17, p. 376, 1942. [Mimeographed.]

Gleditsia triacanthos throughout middle and western Tennessee and the northern half of Mississippi and Alabama is affected by the canker disease due to *Thyronectria austro-americana* [*R.A.M.*, xix, p. 376]. The cankers may be as small as a pin's head or reach ½ in. in diameter. Eventually they enlarge or coalesce and girdle the branch. The fungus also penetrates the vascular system, producing reddish-brown streaking of the outer wood for several inches in each direction from the visible canker. A gummy exudate is present on many cankers. In Tennessee some trees succumb to the disease, but in many areas healthy trees are found near dying ones for a number of consecutive seasons; apparently, considerable natural resistance to infection exists.

Arruda (S. C.). **Observações sôbre algumas doenças do Eucalipto no Estado de S. Paulo.** [Observations on some Eucalyptus diseases in the State of São Paulo.]—*Biológico*, ix, 6, pp. 140–144, 5 figs., 1943.

The most important disease of *Eucalyptus* seedlings in São Paulo is the etiolation and strangulation, followed by rapid wilting and death, caused by *Cylindrocladium scoparium* [*R.A.M.*, xix, p. 221]. Control of the pathogen by soil sterilization with hot water or formalin is a costly process justifiable only for special reasons, the ordinary method consisting in renewal of the soil for the frames and the application to the walls of creolin or a 5 per cent. copper sulphate solution. Soils of an unduly compact texture accumulate an excess of humidity favourable to the growth of the fungus.

E. citriodora is the only species which has been observed to suffer from gummosis (*Phytophthora parasitica*). According to E. Navarro de Andrade ('O Eucalypto e suas applicações', Part I, 143 pp., Secr. Agric., São Paulo, 1928), plantings of the same species and *E. robusta* were attacked in the vicinity of the city of São Paulo by *Phytomonas* [*Bacterium*] *tumefaciens*, causing a mortality of 95 per cent., and the writer has also detected the same organism in plants originating in the United States and Chile.

Nowak (A.). **Neue Erkenntnisse über Holzimprägnierung.** [New knowledge concerning timber impregnation.]—*Dtsch. Bauztg*, lxxvi, 9, pp. 201–202, 1942. [Abs. in *Holz Roh- u. Werkstoff*, vi, 2, p. 68, 1943.]

In the writer's new method of timber impregnation the wood is saturated with water-repellants, such as coal tar pitch, bitumen, or ozocerite, in trichlorethylene as a solvent, the latter being recoverable. The treated wood does not swell appreciably and absorbs considerably less moisture than untreated. By reason of its

comparatively dry state the impregnated wood is highly resistant to fungal damage, so that the addition of any specially toxic fungicide to the preservative is superfluous.

SCHRENK (H. von). **A wood-destroying fungus on Gum ties at Jacksonville, Florida.**—*Plant Dis. Reptr*, xxvi, 11, p. 260, 1942. [Mimeographed.]

A wood-destroying fungus occurring in large numbers on railway sleepers of red or sweet gum (*Liquidambar*), tupelo (*Nyssa*), and black gum (*Nyssa*) wood in Florida, was identified as *Stereum rugosiusculum* [*R.A.M.*, xix, p. 239].

NOBLES (MILDRED K.). **A contribution toward a clarification of the Trametes serialis complex.**—*Canad. J. Res.*, Sect. C, xxi, 7, pp. 211–234, 4 pl., 1 fig., 5 diags., 1943.

The fungus frequently isolated from a destructive, brown, cubical rot of timber or, more rarely, living trees of Sitka spruce (*Picea sitchensis*) and Douglas fir (*Pseudotsuga taxifolia*), had been originally identified by K. St. G. Cartwright on the basis of its cultural characters as *Trametes serialis* [*R.A.M.*, ix, p. 617]. Later it was recognized that the identification had been incorrect, but the name was retained for the time being. Since then the fungus has been identified with a fruit body collected by J. E. Bier on *Picea sitchensis* in the Queen Charlotte Islands, British Columbia, and shown to be a new species. It is here described under the name *Poria microspora* Overholts. In morphological, cultural, and interfertility studies, the author also examined three other species which had been previously confused with *T. serialis*, namely, *P. sequoiae*, *Polyporus palustris*, and a new species, *Poria carbonica* Overholts. On the basis of these studies descriptions are given of all five species, and a brief key for their identification is provided. In interfertility studies the formation of clamp-connexions in all or most of the pairings was accepted as positive proof that the two partners were of the same species, and their complete absence that they belonged to different species. *P. microspora* is characterized by the evanescent nature of the fruit body. The author quotes a letter by Clara W. Fritz for the opinion 'that much of the incipient decay in Douglas fir, which has previously been thought due to *Fomes pini*, is really the result of attack by *P. microspora*'. The cultures of *T. serialis* are easily recognizable by the characteristic fruiting surface, which appears early and eventually spreads over the entire colony, by the abundance of fibre hyphae, and by the nodose-septate hyphae with small refractive projections along their walls. The cultures of *P. sequoiae* resemble those of *T. serialis* in growth rate, but are readily distinguished from them by the absence of fibre hyphae and the resultant lack of toughness in the mat. *Polyporus palustris* differs from the other species examined in its white, cottony mycelium with isolated patches of raised well-formed fruiting surfaces, abundance of fibre hyphae, and rapid growth on gallic and tannic acid agars. Cultures of *Poria carbonica* resemble those of *F. officinalis* in the abundance of secondary spores, but are easily separated from this and other species by the presence of rigid, thick-walled, much-branched hyphae, which are conspicuous under the microscope.

Hosts of viruses on vegetable seedlings.—*Plant Dis. Reptr*, xxvii, 5–6, pp. 146–148, 1943. [Mimeographed.]

Host lists for tobacco mosaic, cucumber mosaic, and spotted wilt viruses have been compiled by the Department of Plant Pathology, Cornell University, for the benefit of florists who have taken to growing vegetable seedlings to meet the war-time demands of small garden-owners. The list only includes hosts likely to be affected under New York conditions.

MIDDLETON (J. T.). **Disease control with fermate and spergon.**—*Plant Dis. Reptr*, xxvii, 7–8, pp. 169–170, 1943. [Mimeographed.]

In glasshouse and field tests in California adequate control of the downy mildews of onion and belladonna (*Atropa belladonna*), caused by *Peronospora destructor* [*R.A.M.*, xxi, p. 63] and *P.* ? *hyoscyami* [ibid., xxi, p. 222], respectively, and of the powdery mildew of cantaloupe (*Erysiphe cichoracearum*) [ibid., xxii, p. 193] was achieved with spergon and fermate, both used at the rate of 1·5 lb. per 100 gals. water. Tomato late blight (*Phytophthora infestans*) was controlled by spergon at 0·25 lb. per 100 gals., but fermate at 1·5 lb. was not appreciably effective.

DAVIS (B. H.). **New seed protectants.**—*Plant Dis. Reptr*, xxvii, 5–6, pp. 150–151, 1943. [Mimeographed.]

In experiments conducted at the New Jersey Agricultural Experiment Station seeds of ten vegetable crops were treated with spergon, thiosan, and tuads, as well as with semesan and red copper oxide for comparison, to test their value against seed decay and damping-off [cf. *R.A.M.*, xxii, p. 261]. All three materials were uninjurious to the seeds. Thiosan and tuads both seemed to give as effective protection as organic mercury (semesan), but they were not so effective as red copper oxide for beets and spinach. The results with spergon were inconsistent: it was as effective as the other chemicals on beans, Lima beans [*Phaseolus lunatus*], and peas, but less so on beet and spinach. [Further details of these tests are given by Davis (B. H.) & Haenseler (C. M.) in *Plant Dis. Reptr*, xxvii, 7–8, pp. 170–171, 1943.]

STAHMANN (M. A.), LINK (K. P.), & WALKER (J. C.). **Mustard oils in crucifers and their relation to resistance to clubroot.**—*J. agric. Res.*, lxvii, 2, pp. 49–63, 1 graph, 1943.

In a study in Wisconsin on the role of mustard oils in resistance to club root, *Plasmodiophora brassicae* [*R.A.M.*, xxi, p. 442], in crucifers, the principal oil found in the roots of all five crucifers examined, was beta phenethyl isothiocyanate, allyl isothiocyanate occurring only in the roots of horse-radish. The former was isolated from the root tissue of resistant and susceptible strains of turnip and black mustard (*Brassica nigra*) and from susceptible strains of white mustard (*B. alba*) and horse-radish. Quantitative estimation of the total mustard oil content and the relative myrosin activity of root tissue, based on improved analytical methods, failed to show any correlation of isothiocyanate content or thioglucosidase activity to resistance or susceptibility to club root. It is concluded that mustard oils play no part in resistance to club root in roots of crucifers.

HILDEBRAND (A. A.) & KOCH (L. W.). **Rhizopus root rot of Sugar Beet.**—*Canad. J. Res.*, Sect. C, xxi, 8, pp. 235–248, 2 pl., 1 fig., 1 graph, 1943.

Sugar beets growing in an experimental plot at the Harrow Laboratory, Ontario, were destroyed in 1942 by a root rot of a type that has been reported only once previously on this host in North America by H. A. Edson (*J. agric. Res.*, iv, pp. 135–168, 1915). The disease causes a wilting of leaves, which at first recover every night but soon become permanently flaccid and eventually turn brown and dry up completely; the tap-root shows a greyish-brown, later almost black rot, which spreading from the base upwards, ultimately covers the entire surface and penetrates deep into the internal tissues. The affected areas, which are clearly delimited from the healthy ones, are spongy and have a strong smell suggestive of acetic acid. Isolations from diseased roots yielded a species of *Rhizopus* in 212 out of 240 tissue plantings. Inoculations of roots with pure cultures of this species were successful in all cases where inoculum was placed in wounds produced by

a cork borer or by wedge excision; but where inoculum was applied to the scalpel puncture type of wound or to an uninjured root, slight infection was obtained in only two out of 24 cases. The causal organism was identified as *R. arrhizus*. In comparative cultural tests *R. nigricans* [*R. stolonifer*] made optimum growth at 24° to 26° C., showing no appreciable growth at 29° to 31° even after 72 hours; *R. arrhizus* and *R. oryzae* made optimum growth at 34° to 36°, with considerable retardation at 39° to 41°. All three species proved capable of infecting wounded beets; their pathogenic capacity varied according to temperature. Thus, whereas the damage caused by *R. stolonifer* was appreciable after four and serious after 21 days at 14° to 16°, but decreased at 20° to 22°, and was quite negligible at 29° to 31°, that caused by the other two species was relatively small at the lowest level, gradually increasing with rising temperature and becoming so destructive at 39° to 41° that roots were completely rotted after four days. The lesions produced by *R. arrhizus* and *R. oryzae* were in general of a deeper brown colour and more clearly delimited from healthy tissue than were those caused by *R. stolonifer*. The conclusion drawn from these investigations is that certain species of *Rhizopus* constitute a potential threat to sugar beets, especially those that have been injured in harvesting or transit and subsequently stored under conditions favourable to infection.

Young (H. C.). **Fertilizer in relation to black root.**—*Sugar*, xxxviii, 9, pp. 35–36, 1943.

This is an abstract of a paper read at a meeting of the Eastern Sugar Beet Technologists in January, 1943. Black root [*R.A.M.*, xix, p. 637], besides causing tonnage losses of varying extent in different beet-growing regions, affects the sugar content and purity of the juice. During the last 20 years the beet yields in northwestern Ohio have sunk from 12 or 15 to 5 tons per acre owing to the depletion of organic matter and other biological and physical changes in the soil, but with the recent replacement of organic matter production has greatly improved, and the incidence of black root has fallen, particularly where phosphoric acid has also been added, either alone or in combination with nitrogen and potash; the two latter are ineffectual by themselves. The phosphate operates most actively when placed just below the seed. In one locality a mixture of manure and fertilizers resulted in almost perfect stands, the yields of which amounted to 20 tons per acre and upwards, black root being automatically combated at the same time.

Young (H. C.). **Control of the blight of the Sugar Beet.**—*Sugar*, xxxviii, 9, p. 36, 1943.

In this abstract of a paper presented at a meeting of the Eastern Sugar Beet Technologists in January, 1943, it is stated that dusting or spraying against beet leaf spot (*Cercospora*) [*beticola*] has resulted in increases of yield up to 6 tons per acre and a rise of $1\frac{1}{2}$ per cent. in the sugar content over a five-year experimental period. Much of the beet-growing territory of Ohio has consequently been equipped with the necessary machinery for fungicidal treatments. The standard formula for dusts is 14 lb. each of fixed copper (50 per cent. metal) and bentonite, WB25–325 mesh and 72 lb. talc, 325 mesh, or 20–80 monohydrated copper-lime, and for sprays either 4–6–100 Bordeaux mixture or a fixed copper 2 or 3–100. Quite apart from leaf spot control the copper was shown by a one-year test to exert a direct stimulus on the plants, producing substantial increases in tonnage yields.

Nitsche (G.) & Förster (H.). **Rübenblattwanze.** [The Beet leaf bug.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 65, pp. 98–99, 1941. [Abs. in *Z. PflKrankh.*, lii, 12, p. 556, 1942].

Adults of the beet leaf bug (*Piesma quadrata*) collected on crinkled plants [*R.A.M.*, xix, p. 318] during the summer and autumn were successful in the

transmission of the virus only in individual cases, whereas 99 per cent. positive infections were obtained after hibernation. Inoculation experiments with nymphs from diseased plants gave negative results, but in the adult stage following hibernation they proved to be vectors of the virus, in spite of having fed as larvae exclusively on healthy seedlings.

CASS SMITH (W. P.). **Bean rust.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 1, pp. 77–79, 2 figs., 1943.

During February, 1943, a serious epidemic of bean rust (*Uromyces appendiculatus*) [*R.A.M.*, xxi, p. 244] developed in market gardens in the Balcatta and Osborne Park districts of Western Australia, many crops being ruined. Plantings on muck, or peaty swamp soils, where atmospheric humidity was high, were more seriously affected than those on light sandy soils under sprinklers. French bean varieties, though affected, were highly resistant compared with runner types. This appears to be the first authentic record of bean rust in Western Australia, but the disease has almost certainly been present in the metropolitan area for some years, at least to a limited extent.

The most suitable control method would appear to be the growing of resistant varieties of the French bean type. Lime-sulphur (1 in 80 to 1 in 100) or a dust containing equal parts of sulphur and air-slaked lime should be applied as soon as the disease is noticed, subsequent treatments being made at weekly intervals until weather conditions no longer favour infection. After harvesting, all crop remains should be removed and destroyed.

BRANDÃO (J. S.). **Algumas doenças do Alho.** [Some Garlic diseases.]—Reprinted from *Bol. Minist. Agric., Rio de J., 1942*, 6 pp., June, 1942.

Popular notes are given on the symptoms and control of the following diseases affecting garlic in Brazil, where Minas Geraes is the leading State in the production of the crop: white rot (*Sclerotium cepivorum*), rust (*Puccinia allii*), purple leaf spot (*Macrosporium* [*Alternaria*] *porri*), mildew (*Peronospora destructor*), dry rot (*Fusarium* sp.), and soft rot (*Bacillus carotovorus*) [*Erwinia carotovora*].

HOPKINS (J. C. F.). **Diseases of fruit, flowers, and vegetables in Southern Rhodesia. 7—Common diseases of Lettuce.**—*Rhod. agric. J.*, xl, 4, pp. 239–241, 7 figs., 1943.

Popular notes are given on the symptoms, cause, and control of the following lettuce diseases in Southern Rhodesia: damping-off, mosaic [*R.A.M.*, xviii, p. 649], tipburn [ibid., xx, p. 242], and leaf spot (*Septoria lactucae*) [ibid., xxi, p. 182].

WHITAKER (T. W.) & PRYOR (D. E.). **Demonstrating downy mildew (Bremia lactucae) in Lettuce.**—*Stain Tech.*, xviii, 3, pp. 121–123, 1 fig., 1943.

Lettuce leaves are placed dorsal side upwards in a moist Petri dish inoculated with a conidial suspension of *Bremia lactucae*, and incubated at 12·5° C. After incubation the material is fixed in an acetic acid-alcohol mixture (1 : 3) for 3½ to 4 hours, the fixing fluid decanted and replaced by a solution of lactophenol-alcohol, and the material transferred to a clean, dry slide and flooded with 1 per cent. cotton blue (aniline blue W.S.) in 90 per cent. alcohol. The host tissues remain colourless in contrast to the fungus, which is stained dark blue.

HASSEBRAUK (K.). **Zur Frage der Verwendung kupferhaltiger Spritzmittel im Kampf gegen den Spargelrost.** [A contribution to the question of the application of copper-containing sprays in the campaign against Asparagus rust.]—*Phytopath. Z.*, xiv, 1, pp. 76–82, 1942.

This is a critical discussion of the results of experiments on asparagus rust

[*Puccinia asparagi*] control by means of copper sprays, with special reference to those of Hülsenberg [*R.A.M.*, xviii, p. 649], to whose optimistic conclusions on the value of the treatment the author does not subscribe. Not only are the toxic effects of the fungicides inadequate, but they are too uncertain to be recommended for general practice. At the same time, pending the development of a more effective remedy, copper-containing sprays must still be employed within reasonable limits, especially on young plantings, where they may successfully avert an epidemic.

WIANT (J. S.). **An analysis of market inspection reports on spoilage of Cantaloups and related Melons.**—*Plant Dis. Reptr*, *Suppl.* 138, pp. 145–161, 1942. [Mimeographed.]

An examination of inspection certificates of a total of 9,890 car lots of melons from Arizona, California, and Colorado, unloaded during 1933, 1934, 1935, and 1941 at New York City markets [*R.A.M.*, xvii, p. 723] (representing approximately half the melons received there from these states during the four years) showed that decays (*Rhizopus*, *Alternaria*, *Fusarium*, *Cladosporium*, and *Phytophthora*, occurring in this order of importance) or moulds [unspecified], or both, were present in 4,400. In these an average of 4·7 per cent. of the melons were affected with decay and 4·8 per cent. with mould; or calculated for the total of 9,890 car lots, 2·1 per cent. decay, and 2·1 per cent. mould, or 4·2 per cent. total spoilage.

A summary is also given of the results of inspections of 3,380 car lots of cantaloupes and 574 of Honey Dew melons from a number of States made at several markets during the period 1922 to 1928 inclusive. Decay was present in 22·2 per cent. of all car lots, with an average of 10·7 per cent. in each; or on the basis of all car lots, decay averaged 2·4 per cent. of all melons inspected.

MIDDLETON (J. T.) & WHITAKER (T. W.). **A lethal virus disease of Cantaloup occurring in the Imperial Valley.**—*Plant Dis. Reptr*, xxvi, 15, p. 331, 1942. [Mimeographed.]

A destructive disease of cantaloupes, caused by a strain of the cucumber mosaic virus, is reported from the Imperial Valley of California, where approximately 75 per cent. of the crop was lost in two early plantings comprising 250 acres. The symptoms consisted in a sudden dying of the older leaves and subsequent yellowing of the runners, which collapse two to four days later, and in necrotic streaks on the stems of the runners. Unlike the common cantaloupe mosaic, which has been prevalent in the same region for many years, the new disease shows no mosaic pattern on older leaves and only a very faint one on the younger leaves. Greenhouse inoculations with juice from diseased plants were successful with cantaloupes, and also with squash and cucumber, producing in the last-named two hosts symptoms similar to those of the common cucumber mosaic virus. Owing to the lethal effect of this strain of cucumber virus on cantaloupe, it is considered improbable that it is seed-borne.

PINCKARD (J. A.) & ANDERSON (W. S.). **New disinfectants for Sweetpotatoes.**—*Plant Dis. Reptr*, xxvii, 5–6, pp. 151–153, 1943. [Mimeographed.]

Of the various seed-piece disinfectants tested at the Mississippi Agricultural Experiment Station in 1942 for controlling black rot disease of sweet potato (*Ceratostomella fimbriata*) [*R.A.M.*, xxi, p. 515], sinox and elgetol showed promise, while spergon, used with a wetting agent, was of little value.

MANNS (T. F.). **A new root-dip treatment for Sweet Potato sprouts to control wilt.**—*Trans. Peninsula hort. Soc.*, xxxii, 5, pp. 80–81, 1943.

In field tests carried out in Delaware in 1942 root-dip treatments of sweet

potato against wilt [*Fusarium oxysporum* f.2 and *F. bulbigenum* var. *batatas*] with spergon [*R.A.M.*, xxi, p. 360] gave 33·4 per cent. average increased yield over the untreated controls, as against 8·4 per cent. for improved semesan bel and 13·1 per cent. for yellow cuprocide.

PORTER (R. P.). **Seed-borne inoculum of Phomopsis vexans—its extent and effects.**—*Plant Dis. Reptr*, xxvii, 7–8, pp. 167–169, 1943. [Mimeographed.]

Spores of *Phomopsis vexans* [*R.A.M.*, xxii, p. 194] were found in 6 of the 27 seed samples of 12 varieties of eggplant examined at the Virginia Truck Experiment Station, all six belonging to the variety Black Beauty. Seed artificially contaminated with *P. vexans* planted in sterile soil reduced the stand by 10·7 per cent., healthy seed in contaminated soil showed a reduction of 19·8 per cent., and contaminated seed in contaminated soil one of 22·5 per cent. of that obtained with healthy seed in sterile soil, indicating the importance of using disease-free seed and planting in disease-free seed-beds.

Soya Beans in South Africa.—*Bull. Dep. Agric. S. Afr.* 240, 58 pp., 16 figs., 1943.

Included in this summary of the available information on the production, economic aspect, and nutritional and industrial uses of soy-beans, now coming into general commercial cultivation in South Africa, is a brief note on the few diseases affecting the crop in its new habitat, of which only one, bacterial blight (*Bacterium glycineum*) [*Pseudomonas glycinea*] has so far been of much importance. Other diseases of more or less sporadic occurrence are powdery mildew [*Erysiphe polygoni*], downy mildew [*Peronospora trifoliorum*], anthracnose [attributed in most countries to *Glomerella glycines*: *R.A.M.*, vi, p. 75], and *Sclerotium* wilt [*S. rolfsii*].

MCLAUGHLIN (J. H.). **Notes on diseases of Soybeans and other Legumes in Oklahoma.**—*Plant Dis. Reptr*, xxvi, 16, pp. 356–359, 1942. [Mimeographed.]

During 1941, of 30 varieties and selections of field soy-beans growing on the Oklahoma Experiment Station farm, only Chief, Arksoy 152, and C-146 remained relatively unaffected by *Phytomonas* [*Xanthomonas*] *phaseoli* var. *sojense* [*R.A.M.*, xviii, p. 379]. None of 27 edible varieties showed resistance, though Fuji developed only moderate infection. In another test of field soy-beans, grown from seed obtained locally, Habaro and Scioto were slightly infected, while Ogden showed a trace of infection.

TERVET (I. W.). **Soybean diseases in Minnesota.**—*Plant Dis. Reptr*, xxvii, 5–6, pp. 135–138, 1943. [Mimeographed.]

Reactions of 50 varieties and selections of soy-bean to mosaic, mottle leaf, and bacterial blight (*Phytomonas* [*Pseudomonas*] *glycinea*) [*R.A.M.*, xix, p. 256] were recorded during 1942 in Minnesota. The records show that although some varieties are immune from mosaic or mottle leaf, or both, none is immune from bacterial blight. Those immune from both viruses are F.P.I. Nos. 79610 and 92470, Minn. Sel. Nos. 118, 120, and 123 of Wis. Manchu No. 3, Minn. Sel. No, 107 of Minn. Manchu, and Holland No. 11.

CHRISTENSEN [C. M.). **Common edible Mushrooms.**—x+124 pp., 4 col. pl., 62 figs., 2 diags., Minneapolis, University of Minnesota Press, 1943. $2.50.

In this attractively presented book 47 varieties of edible wild fungi, classed according to the spore print, are described in detail. The author suggests that the novice should learn to recognize a few species well and avoid all others, a chapter on 'the fool-proof four' being devoted to four common and easily recognizable species. The concluding section of the book deals with mushroom cookery.

THOMAS (K. M.), RAMAKRISHNAN (T. S.), & NARASIMHALU (I. L.). **Paddy straw Mushroom.**—*Madras agric. J.*, xxxi, 2, pp. 57–59, 1 fig., 1943.

Full directions, based on the system employed by U. T. Su in Burma, are given for the cultivation of the 'paddy straw' mushroom (*Volvaria diplasia*) in Madras [*R.A.M.*, xx, p. 100].

SĂVULESCU (T.). **Rumania. Bacterial gummosis of the Sugarbeet.**—*Int. Bull. Pl. Prot.*, xvii, 3, pp. 34M–39M, 1943.

During 1942, sugar beets were attacked by bacterial gummosis [*R.A.M.*, vii, p. 294] over almost the entire area devoted to this crop in the Danubian Plain of Rumania, from the Dolj Department to the Ialomita Department. The total crop, which usually amounts to 6,000 wagon-loads, was reduced to 3,000, of which only 2,400 could be utilized. As the affected beets contained an appreciable quantity of inverted sugar, and as impurities were 10 to 20 or even 30 per cent. above normal, the qualitative and quantitative production showed an estimated loss of 70 to 80 per cent. and even more in some areas. The disease was favoured by prolonged drought. Excessive and prolonged dry spells in summer reduce the osmotic force of the roots. This produces the first characteristic symptom, the shrivelling of the root tips. There is then no sign of rot, but the beets remain small.

Absence of boron is the main predisposing factor, both as regards this bacterial gummosis and the heart rot that follows wet weather. The intensity of both conditions is also directly related with the calcium carbonate content of the soil. It was found that these diseases do not appear in fields containing under 2 or over 8 to 9 per cent. calcium carbonate, while they commonly occur in soil containing 3 to 4 per cent. Bacterial gummosis is very frequent in soils with a reaction of P_H 7·3 to 7·8, but as soon as alkalinity is reached, intensity does not vary parallel with the P_H. Sugar beet soils locally are usually rich in potassium and poor in phosphorus. There is no direct correlation between the content of plant nutrients in a given soil and the prevalence of the disease.

Beets predisposed to disease as indicated above are attacked first by '*Bacillus betae*', which was abundantly present in the mucilage of affected beets. Other bacteria isolated included *B.* [*Erwinia*] *bussei* and '*B. lacerans*', and the organism also found by the author in 1924 [loc. cit.]; this liquefies gelatin, does not produce gas, develops rapidly on agar, and inverts sugar. With these are associated saprophytic bacteria and fungi. In stored diseased beets yeasts transform the inverted sugar into alcohol, and the acetic fermentation ensues.

Sugar beets should not be cultivated for at least three years in any field that has shown the condition. A four-year rotation should be closely followed. Soils with over 3 per cent. calcium carbonate, or very light soils, should be avoided. In the Danubian Plain preference should be given to the river banks, where the water level is high. Applications of borax (20 to 30 kg. per ha.) have always been beneficial. Beet seed should be disinfected by 15 minutes' immersion in a solution of formalin (250 gm. per 100 l. water). Once the disease has appeared, all diseased plants must be pulled up and burnt on the spot. Diseased beets sent to the mills must also be burnt. Good methods of cultivation are essential, and resistant varieties must be selected.

MOINAT (A. D.). **Nutritional relationships of boron and indoleacetic acid in Head Lettuce.**—*Plant Physiol.*, xviii, 3, pp. 517–523, 2 figs., 1943.

In greenhouse studies conducted at the University of Chicago with lettuce plants of the variety New York the addition of as little as 0·005 p.p.m. of boron to the nutrient solution prevented the development of boron deficiency [*R.A.M.*, xxi, p. 317] symptoms, while indoleacetic acid sprayed on the leaves failed to do so; neither treatment prevented the appearance of tipburn [ibid., xx, p. 242].

INDEX OF AUTHORS

GENERAL INDEX